# REPORT
OF
# NATIONAL BOARD OF FIRE UNDERWRITERS
BY ITS
## COMMITTEE OF TWENTY
ON THE
# CITY OF NEW YORK, N. Y.
## MANHATTAN AND THE BRONX.



The report on New York, N. Y., Boroughs of Manhattan and The Bronx, was compiled mainly from data collected during the months of May to October, 1905, inclusive, by an engineering party organized as follows:

F. A. RAYMOND, Engineer in charge of party and Fire Department work.
J. W. DUB. GOULD, Engineer in charge of Hydraulic work.
E. V. STARKWEATHER, F. B. TEST, A. C. NOBLE, and assistants. } Engineers in charge of Structural work.
E. L. WALKER, Engineer in charge of party to August 15.

Acknowledgment is made of valuable assistance rendered by the Hon. Geo. B. McClellan, Mayor, and the heads and officials of the various city departments concerned; also by Manager Henry E. Hess and the different officials of the New York Fire Insurance Exchange, and by Mr. Wm. A. Anderson, Superintendent Bureau of Surveys, together with the officials of the New York Board of Fire Underwriters.

Particular acknowledgment is due Mr. I. M. de Varona, chief engineer of the Department of Water Supply, Gas and Electricity for unusual assistance rendered in obtaining data for the report on water supply.

# ARRANGEMENT OF REPORT.

An outline is given below of the general topics covered in the report. The order is uniform. Where there is a decrease in the size of the type in the report, the matter in the smaller type is understood to be a subdivision or subheading of that in the next preceding larger type.

**CITY IN GENERAL.**

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  - Equipment.
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- FIRE DEPARTMENT AUXILIARIES.
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- ELECTRICITY.
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  - In General.
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**RECOMMENDATIONS.**—In the same order as the above.

**GENERAL SUMMARY.**— " " "

As an engineer officer, detailed by the War Department, at the request of the Committee of Twenty, to co-operate with them in the investigation of conditions affecting the fire and conflagration hazards in cities of the United States, I certify that I have visited New York City, and in so far as possible, by a survey of visible physical conditions, especially in those sections in which the hazard is bad, have verified the general features of this report. So far as my observations extended, they confirmed the report on all questions of fact.

The type and occupancy of buildings prevailing in the worst sections, their mutual exposures, the narrowness of streets, inadequacy of water supply and distribution, together with the enormous values involved, combine to make of the situation in Manhattan by far the most serious fire and conflagration hazard I have ever seen. The conclusion is inevitable that the magnificent personnel of the fire department has been the only thing that has prevented sweeping conflagrations in the past. The existing physical conditions, not to mention inefficient engines and a deteriorated alarm system, constitute a handicap under which any mere human agency, however perfect, must ultimately fail.

In view of the enormous interests involved, and the almost international character of the catastrophe which would be represented by a sweeping conflagration in Manhattan, no time should be lost in putting into effect all the proposed improvements, and all the recommendations in this report, or their full equivalent.

In my judgment, the description of existing dangers in this report is, if anything, too conservative, the hazard is at least as real, and serious, and imminent, as herein stated. The adoption of the recommendations in full would reduce it to a practical minimum, and no lesser measures will suffice.

(Signed) JOHN STEPHEN SEWELL,
*Captain, Corps of Engineers, U. S. Army.*

WASHINGTON, D. C., November 27, 1905.

# REPORT

ON THE

# CITY OF NEW YORK, N. Y.

## COMMITTEE OF TWENTY

OF

## National Board of Fire Underwriters.

135 William Street, New York.

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### CITY OF NEW YORK, N. Y.,
Manhattan and The Bronx.

ERRATA.

Page 4, Property Valuation.—"TOTAL" should read as follows:

| 1904. | 1905. |
|---|---|
| $4,185,336,066 | $4,389,156,971 |
| 275,783,430 | 291,533,218 |
| 990,568,732 | 1,031,894,265 |
| 138,856,650 | 149,499,728 |
| 49,997,779 | 50,072,045 |
| $5,640,542,657 | $5,912,156,227 |

Page 22, Line 2.—Water Supply.—For "southern" read "northern."

Page 66, Fourteenth line from bottom of page in left column.—"Mr. Walter Cook," should read, "Mr. William J. Fryer."

Page 94, Recommendation 86.—Fire Department Auxiliaries.—This recommendation should read as follows:

That the owners of extensive establishments be encouraged to equip their premises with some improved manual or automatic alarm system.

J. Butler.

**Police Commissioner.**—William McAdoo.

dent, Carl Schurz; secretary, Elliot H. Goodwin.

# REPORT

ON THE

# CITY OF NEW YORK, N. Y.

## MANHATTAN AND THE BRONX.

## CITY IN GENERAL.

### CIVIC AFFAIRS.

**MUNICIPAL GOVERNMENT.—**
**Mayor.**—Hon. Geo. B. McClellan.
**Comptroller.**—Edward M. Grout.
**President of Board of Aldermen**—Charles V. Fornes. The Board consists of the president and 73 additional members.
**Borough Presidents:**
Manhattan, John F. Ahearn.
Bronx, Louis F. Haffen.
Brooklyn, Martin W. Littleton.
Queens, Joseph Cassidy.
Richmond, George Cromwell.

All of the above officers are elected by popular vote for terms of two years, expiring December 31, 1905, after which time the terms of the mayor, comptroller, borough presidents and president of Board of Aldermen will be four years.

**Board of Estimate and Apportionment.**—This consists of the mayor, comptroller, president of the Board of Aldermen and the presidents of the various boroughs. They are entitled to cast votes as follows: The mayor, comptroller and president of the Board of Aldermen, 3 votes each; presidents of the Boroughs of Manhattan and Brooklyn, 2 votes each; presidents of the boroughs of The Bronx, Queens and Richmond, one vote each.

**Commissioner of Water Supply, Gas and Electricity.**—John T. Oakley.

**Aqueduct Commission.**—The mayor and comptroller, *ex officio;* John F. Cowan, president; Wm. H. Ten Eyck, John J. Ryan, John P. Windolph.

**Board of Water Supply.**—J. Edward Simmons, president; Charles N. Chadwick, Charles A. Shaw.

**Fire Commissioner.**—Nicholas J. Hayes.

**Municipal Explosives Commission.**—Fire commissioner, *ex officio*, chairman; William Montgomery, John Sherry, Abraham Piser.

**Tenement House Commissioner.**—Edmond J. Butler.

**Police Commissioner.**—William McAdoo.

All these officers are appointed by the mayor for an indefinite term.

Other important officials are: **Commissioner of Public Works in Manhattan; Commissioner of Public Works in the Bronx; Superintendent of Buildings, Manhattan; Superintendent of Buildings, Bronx;** all appointed by the president of their respective boroughs. **Commissioner of Health; Commissioner of Bridges; Commissioner of Docks and Ferries; Commissioner of Street Cleaning; Municipal Civil Service Commission,** W. F. Baker, president; **Superintendent of Highways, Manhattan; Superintendent of Highways, Bronx; Superintendent of Public Buildings, Manhattan; Superintendent of Public Buildings, Bronx.**

**COMMERCIAL BODIES.—Chamber of Commerce.**—Organized 1768; membership, 1,500; president, Morris K. Jesup; secretary, George Wilson.

**The Merchants Association of New York.**—Organized 1897; membership, 31,400; president, Clarence Whitman; secretary, S. C. Mead.

**New York Board of Trade and Transportation.**—Organized 1873; membership, 1,400 corporations and individuals; president, William McCarroll; secretary, Frank S. Gardiner.

**Merchants and Manufacturers' Board of Trade of New York.**—President, C. C. Shayne; secretary, L. C. Ketchum.

**Manufacturers' Association of New York.**—Organized 1894; membership, 350; president, Frederick H. Webster; secretary, P. T. Tunison.

**CIVIC ORGANIZATIONS.**—City Club of New York.—Organized 1892; membership, 1,130; president, Austen G. Fox; secretary, Lawrence Veiller.

**Municipal Art Society.**—President, Charles Robinson Lamb; secretary, Gabriella Stewart.

**City Vigilance League.**—President, Dr. Matthew Beattie; secretary, Thos. L. McClintock.

**Civil Service Reform Association.**—President, Carl Schurz; secretary, Elliot H. Goodwin.

**PROPERTY VALUATION.**—Valuation of property assessed for taxation in 1904:

| Borough. | Real Estate. | Personal. | Total. |
|---|---|---|---|
| Manhattan... | $3,676,857,411 | $508,478,655 | $4,853,360,066 |
| Bronx..... | 261,026,477 | 14,756,953 | 275,883,430 |
| Brooklyn.... | 901,994,957 | 88,573,775 | 990,468,732 |
| Queens..... | 131,379,225 | 7,477,425 | 138,856,650 |
| Richmond... | 44,205,709 | 5,792,070 | 49,997,779 |
| Total..... | $5,015,463,779 | $625,078,878 | $5,640,542,657 |
| Valuation of property in 1905: | | | |
| Manhattan... | $3,820,756,181 | $568,400,790 | $4,389,156,971 |
| Bronx..... | 274,859,593 | 16,673,625 | 291,533,118 |
| Brooklyn .. | 940,982,302 | 90,911,963 | 1,031,894,265 |
| Queens..... | 140,404,990 | 9,094,738 | 149,499,728 |
| Richmond... | 44,581,235 | 5,490,810 | 50,082,045 |
| Total..... | $5,221,584,301 | $690,571,926 | $5,912,156,227 |

**TAX RATE.**—The tax rate fixed by the Board of Aldermen for 1905 is as follows:

| | |
|---|---|
| Manhattan and the Bronx | $1.49 (per $100) |
| Brooklyn | 1.56 |
| Queens | 1.55 |
| Richmond | 1.55 |

The budget for the year is $109,817,593; after deducting income of the general fund, the amount to be raised by levy is $82,796,242.

Property is supposed to be assessed at 100 per cent. of value. Government, state and municipal property and property of religious or scientific institutions when not conducted for gain, and of eleemosynary institutions, are untaxed.

## AREAS.

Including all open spaces, these are as follows:

| | Square Miles. | Acres. |
|---|---|---|
| Greater New York | 326.90 | 209,218 |
| Borough of Manhattan | 21.93 | 14,038 |
| Borough of the Bronx | 40.65 | 26,017 |
| Manhattan and the Bronx | 62.58 | 40,055 |

## POPULATION AND GROWTH.

The population of the whole city by State Census of June 1, 1905, was 4,014,304, of which the Boroughs of Manhattan and The Bronx had 2,384,326. The population of the latter boroughs by U. S. Census of 1890 and 1900 and State Census of 1905 was as follows:

| | 1905 | 1900 | 1890 |
|---|---|---|---|
| Manhattan | 2,112,697 | 1,850,093 | 1,441,216* |
| The Bronx | 271,624 | 200,507 | 88,908* |

* Estimated population of present area of borough.

The increase in population of the whole city for the five-year period from 1900 to 1905 was 16.8 per cent., as compared with a somewhat greater increase for the same area during the ten-year period from 1890 to 1900, or 37.1 per cent. The increase in Manhattan borough has been remarkably steady from 1890 at an average rate of 14.2 per cent. for each five-year period. The growth of The Bronx has been particularly rapid; the five-year period from 1900 to 1905 showed a gain of 35.5 per cent., and 125.5 per cent. for the same area during the 10 years from 1890 to 1900.

## PRINCIPAL INDUSTRIES.

The principal manufacturing and mechanical industries of New York City (Boroughs of Manhattan and Bronx) from U. S. Census report 1900, are as follows:

| | Capital. | Average Number of Employees. |
|---|---|---|
| Artificial feathers and flowers. | $2,922,939 | 3,943 |
| Book binding and blank books | 3,958,699 | 5,871 |
| Bread and bakery products | 10,026,820 | 7,678 |
| Clothing, men's custom work. | 6,966,058 | 6,474 |
| " " factory " | 34,778,035 | 23,361 |
| Clothing, men's factory button-holes | 30,265 | 207 |
| Clothing, women's dressmaking | 4,117,478 | 6,653 |
| Clothing, women's factory products | 26,386,029 | 42,065 |
| Confectionery | 4,339,139 | 3,931 |
| Electrical apparatus and supplies | 8,342,500 | 4,344 |
| Engraving, steel and plate printing | 3,562,370 | 1,588 |
| Foundry and machine shop products | 20,253,967 | 10,649 |
| Fur goods | 6,284,996 | 3,920 |
| Furnishing goods, men's | 7,183,354 | 7,148 |
| Furniture and cabinet making | 8,333,967 | 7,710 |
| Iron work, arch and ornamental | 3,427,829 | 2,650 |
| Gas, illuminating and heating. | 103,864,257 | 3,612 |
| Jewelry | 5,106,465 | 2,744 |
| Liquors, malt | 46,281,439 | 2,920 |
| Lithographing and engraving. | 8,284,599 | 3,838 |
| Masonry, marble, brick and stone work | 11,466,075 | 11,493 |
| Millinery and lace goods | 7,556,004 | 10,609 |
| Musical instruments | 9,342,701 | 4,840 |
| Paints | 5,478,046 | 985 |
| Patent medicines and compounds | 4,625,547 | 836 |
| Paving and paving material. | 7,969,272 | 957 |
| Plumbing, gas and steam fitting | 3,894,408 | 5,675 |
| Printing and publishing; book and job | 18,064,320 | 11,975 |
| Printing and publishing; music | 987,093 | 215 |
| Printing and publishing; newspapers and periodicals | 38,258,674 | 8,982 |
| Shirts | 4,479,793 | 4,120 |
| Silk and silk goods | 4,428,148 | 4,001 |
| Silverware | 2,535,046 | 1,159 |
| Slaughtering and meat packing | 8,548,436 | 1,705 |
| Soap and candles | 3,213,358 | 792 |
| Sheet metal work | 3,440,944 | 2,989 |
| Tobacco, cigars and cigarettes | 14,328,391 | 19,308 |

## TOPOGRAPHY.

Manhattan Island is a long narrow strip extending southwest and northeast between the Hudson river and the tidal channel connecting Long Island Sound and New York Bay and known as East river. It is 13 miles long and averages about two miles wide, except at the northern end. The northern part is hilly, reaching elevations of 160 to 220 feet. The southern part is low, with elevations up to 100 feet. Elevation in mercantile section from 0 to 40 feet above mean sea level.

The Bronx lies north of Manhattan Island and is separated from it by the Harlem river. On the eastern side are salt water marshes and low meadows. Several north and south ridges extend through The Bronx, increasing in height to the western side, where they attain the height of 280 feet above mean sea level. The mercantile section lies in the southern part at elevations below 60 feet.

## STREETS.

**STREET DEPARTMENT.**—The president of the Borough has cognizance and control of all matters relating to improvements and repairs of streets and sewers. He may appoint or remove at pleasure a Commissioner of Public Works for his borough. The commissioner exercises all the administrative power of the president of the borough relating to streets, sewers, etc. The commissioner for Manhattan is William Dalton; for The Bronx, Henry Bruckner.

**GRADES AND PAVEMENTS.—Grades.**—The Island of Manhattan is comparatively level and with few exceptions, mostly in the upper end, the street grades are light, although there are numerous cases where there are grades from 5 to 8 per cent.

Some of the steeper grades at important localities in the borough of Manhattan are the following:

| | | |
|---|---|---|
| Lexington Ave.. | 102nd to 103rd Street. (Duffy's Hill) | 12.6% Specification granite. |
| 100th St.. | Lexington to 3rd Avenue. | 8.1% Specification granite. |
| 141st " .. | St. Nicholas to Amsterdam Avenue.... | 11.1% Specification granite. |
| 135th " .. | St. Nicholas Pl. to St. Nicholas Terrace... | 10.88% Specification granite. |

Heavy grades can generally be avoided by the fire department; the only two which have to be much used are Lexington avenue, One Hundred and Second to One Hundred and Third streets and One Hundred and Forty-first street, St. Nicholas to Amsterdam avenues. North and south from One Hundred and Twenty-fifth street on Broadway and Amsterdam avenue there are very long hills up what is known as Manhattan Valley. The fire apparatus receives ordinarily aid up these long hills from the street railways, where surface lines exist. On the whole, the steep grades are not a serious drawback to the passage of fire apparatus.

In the thickly settled districts of The Bronx, the streets are fairly level and well paved for the most part. There is a considerable grade on the cross streets between Melrose and Courtlandt avenues, but this is not steep enough seriously to delay apparatus.

The tracks of the N. Y., N. H. & H. R. R. and the N. Y. C. & H. R. R. R. are depressed and crossed by many bridges, thus forming little impediment to the movements of fire apparatus; but in the southern part of The Bronx the extensive freight yards with few cross streets are a source of serious delay to the fire department.

In the scattered residence districts there are many hills and the snow in winter causes some trouble, but serious fires cannot occur here for lack of material.

**Obstructions.**—The freight trains, frequently left standing on the tracks of the N. Y. C. & H. R. R. R. Co. in Tenth and Eleventh avenues and in Hudson and Canal streets, are apt to obstruct the passage of fire apparatus seriously. The pillars of the elevated railway structures, especially on the Third and Sixth avenue lines, are a considerable obstruction to the apparatus, and many accidents have resulted from collisions with them. The Bowery, with four lines of car tracks and two elevated lines, is also a hindrance and dangerous. The corner of Liberty and William streets is dangerous on account of both streets intersecting at grades of about 5 per cent.

Streets congested by traffic often delay the fire apparatus, especially in the downtown district, where many of the streets have roadways of only from 20 to 30 feet and in some cases have double lines of car tracks. These conditions are especially bad in winter, when only the car tracks are swept clear of snow, the snow being piled high on the sides.

Especially congested streets are as follows:

*Uptown.*—First avenue, from Twenty-third north to One Hundred and Tenth streets; Fifth avenue from Ninth to Fifty-ninth streets; Eighth avenue, Thirteenth to Fifty-ninth streets.

*Downtown.*—Fulton street, with 25 foot roadway and double car line, badly paved and congested. Nassau street, 20 foot roadway. Maiden Lane and Cortlandt street, with roadway from 20 to 40 feet. West street below

Cortlandt. Fourth street east of Fifth avenue, 30 foot roadway (automobiles, etc., turn off here to reach Broadway). West Broadway between Chambers and Dey streets, double surface lines and elevated pillars. Frankfort street at Park Row, constantly blocked by newspaper delivery wagons.

Central Park forms a barrier between the east and west sides of the city, each district being separately protected, and the fire companies do not respond east and west across the park, but have long runs north and south in their own districts.

The Grand Central Station railway yard also separates that part of the city into districts, but companies on either side respond on second alarm to the other side.

The Harlem River offers little obstruction to the passage of engines owing to the numerous bridges.

**Pavements.**—The surfacing of the streets is, on the whole, good, and such poor surfacing as exists is not considered by the fire department a hindrance to the passage of apparatus. Torn up streets, however, frequently delay apparatus; 29,328 street openings were made during 1904 and 87.9 miles of trenches were opened for street mains, not including openings made in the surface of pavements by the Bureau of Highways and by asphalt paving companies, street railway and subway companies, etc.

In making repairs in all crowded streets only one-half of the street is shut off at a time. If the street is shut off entirely, the fire department is notified.

CLASSIFICATION OF PAVEMENTS, BOROUGH OF MANHATTAN.

| Kind of Pavement. | Lineal Miles laid in 1904. | Total Lineal miles laid to Jan. 1, 1905. | Per Cent. of total miles. |
|---|---|---|---|
| Specification granite. | 2.21 | 107.27 | 25.6 |
| Square granite..... | ..... | 6.80 | 1.6 |
| Specification trap.... | ..... | 28.88 | 7.0 |
| Belgian " ... | ..... | 4.07 | 1.0 |
| Sheet asphalt..... | 18.02 | 228.29 | 54.7 |
| Block " ..... | 2.10 | 21.41 | 5.1 |
| Cobble..... | ..... | .79 | 0.2 |
| Wood block..... | 1.12 | 1.14 | 0.3 |
| Macadam ..... | ..... | 18.91 | 4.5 |
| Total..... | 23.45 | 417.56 | 100.0 |

NOTE.—There are, besides the macadam roads, 19 miles of dirt roads in the Borough of Manhattan.

CLASSIFICATION OF PAVEMENTS, BOROUGH OF BRONX.

| Kind of Pavement. | Lineal Miles laid in 1904. | Total Lineal Miles laid to Jan. 1, 1905. | Per Cent. of Total Miles. |
|---|---|---|---|
| Specification granite. | 1.157 | 34.610 | 42.2 |
| Square granite..... | | | |
| Specification trap.... | 0.430 | 3.855 | 4.7 |
| Belgian " ... | (torn up.) | | |
| Sheet asphalt..... | 4.018 | 31.782 | 39.0 |
| Block " ..... | 5.210 | 9.778 | 12.0 |
| Cobble..... | | | |
| Wood block..... | 0.460 | 0.460 | 0.5 |
| Brick ..... | ..... | 1.391 | 1.6 |
| Total..... | 10.415 | 81 876 | 100.0 |

NOTE.—There are 106 miles of macadamized streets in the Borough of The Bronx. The total mileage to December 31, 1904, of earth and other roadways not paved in The Bronx is 343 miles.

**WIDTHS.— Manhattan.—** *Downtown.*— In the congested downtown district streets are mostly under 70 feet wide, and many are narrow and irregular, with widths varying from 20 to 60 feet. Exceptions to the above may be noted as follows:

| | |
|---|---|
| Canal Street, | 100 feet wide. |
| Broad " | 76 to 83 feet wide. |
| Bowery, | 112 " 122 " " |
| Delancey Street, | 150 feet wide. |
| Hudson " | 90 " " |
| West Broadway | 75 " " |

Marginal Street, on East Side 150 feet wide.

Broadway is on the average 75 feet wide from Bowling Green to Canal street, and 80 feet between the latter point and Twentieth street.

*Uptown.*—In the uptown district above Houston street all streets are 60 feet wide between building lines, with the following exceptions:

One Hundred and Eighty-fifth street is 80, One Hundred and Twenty-second street west of Ninth avenue is 80, One Hundred and Twenty-seventh street west of Eleventh avenue is 100, One Hundred and Tenth street, Fifth to Seventh avenues, is 70, and from Seventh avenue to Broadway, 100 feet wide, and these streets are 100 feet wide throughout:

| | | | | |
|---|---|---|---|---|
| 14th | 57th | 96th | 135th | 175th |
| 23rd | 72nd | 106th | 145th | 195th |
| 34th | 79th | 116th | 155th | 205th |
| 42nd | 86th | 125th | 165th | 215th |

All avenues are 100 feet wide except the following:

| | | | |
|---|---|---|---|
| Avenue A, | south of 23rd Street, | 80 | feet wide. |
| " B | " " " " | 60 | " " |
| " C | " " " " | 80 | " " |
| " D | " " " " | 60 | " " |
| Boulevard | | 150 | " " |
| Lexington Avenue, | | 75 | " " |
| Madison " | , south of 42d Street, | 75 | " " |
| " " | , north " " " | 80 | " " |
| " Avenue, | between 120th & 124th Sts., | 100 | " " |
| Fourth Avenue, | north of 34th Street, | 140 | " " |
| Sixth " | " " 110th " | 150 | " " |
| Seventh " | " " 110th " | 150 | " " |
| Eleventh " | " " 107th " | 150 | " " |

**The Bronx.**—In The Bronx, north and south streets vary in width from 60 to 100 feet, averaging about 80 feet; Aqueduct avenue is from 100 to 156 feet, Grand boulevard 182 feet, Park avenue 100 to 165 feet in width. The east and west streets are generally from 60 to 80 feet in width, with a few wider streets at irregular intervals, such as Southern boulevard, One Hundred and Thirty-eighth street, One Hundred and Forty-ninth street, One Hundred and Sixty-first street, One Hundred and Sixty-third street, Wendover avenue, One Hundred and Seventy-seventh street, Pelham avenue, Two Hundredth street, Gun Hill road and Two Hundred and Thirty-third street, which are 100 feet wide. Above One Hundred and Seventy-seventh street about one-half the streets are 50 feet in width, with the remainder varying from 60 to 80 feet wide. In the mercantile section at the southern end of The Bronx nearly all the north and south streets are 80 to 100 feet wide, with the east and west cross streets 60 feet in width.

## FUEL.

Coal is the principal fuel used for manufacturing purposes, in about the proportion of 70 per cent. anthracite and 30 per cent. bituminous. The ordinance against the smoke nuisance is partially responsible for the general use of anthracite. For domestic purposes gas and anthracite are commonly used.

## WINDS.

Records of the U. S. Weather Bureau for the nine years from 1894 to 1902 show that average velocities during the period from November to April range between 10.4 and 22.7 miles per hour, with a mean of 15.0, and during the period from May to October range between 8.0 and 15.7 miles per hour, with a mean of 12.2. The mean yearly velocities during the nine years vary from 10.3 to 14.8 miles per hour, the mean for the entire period being 13.4. The number of gales exceeding 40 miles per hour during each year averages about 46, with a maximum of 89, a somewhat larger proportion occurring in the winter than in the summer months. The maximum velocity recorded during same period was 80 miles per hour, in 1899. Velocities between 47 and 72 miles per hour are reached during single storms practically every year. There are no hills sufficiently high to shield the city from high winds, except at the northern end of Manhattan Island, where Washington Heights partially protect Harlem and Mott Haven. The prevailing direction of the wind is northwest, with a few storms from the north and northeast.

The city is, therefore, subject to rather high winds on the average, as compared with other cities.

## TEMPERATURES.

From records of nine years, 1894 to 1902, inclusive, obtained from the United States Weather Bureau at New York.

| Month. | Minimum Temperature Recorded, Fahr. | Mean Monthly Temperature, Fahr. | Average Number Days per Month when Minimum Tem. was below 32° Fahr. | Average Number of Days per Mo. when Maximum Temp. was below 32° Fahr. |
|---|---|---|---|---|
| November.... | 17 | 45.4 | 5.3 | 0.5 |
| December.... | 7 | 34 9 | 17.3 | 5.9 |
| January..... | —3 | 30.8 | 23.7 | 7.4 |
| February..... | —6 | 29.2 | 22.8 | 9.1 |
| March..... | 10 | 39.1 | 13.3 | 1.7 |

The mean annual temperature for the whole period is 52.5 degrees, and it will be noticed that extended periods of severe cold weather are common.

## FIRE RECORD.

**GENERAL.**—The fire losses for many years have been large, and the loss per capita rather high, as is usual in the larger cities. During the '90s the annual insured losses (reported by the New York Board of Fire Underwriters) ranged from $3,010,000 to $7,181,000, the average being $4,473,000. These figures do not differ materially from those reported by the fire department. Since 1899 the annual losses have varied very little, averaging $5,406,000. These figures show an average loss per capita of $2.55 during the '90s and $2.45 for the five succeeding years. The average loss per fire reported by the fire department was extremely high for many years, but has steadily decreased from $3,260 per fire in 1881 to $615 per fire in 1903. The average loss per fire in both 1902 and 1903 according to the same authority, was moderate. These figures, however, differ widely from those in the reports of the fire patrol, the discrepancies appearing between Tables Nos. 2 and 3. The number of fires to 1,000 population has usually been moderate, averaging about 2.4 during the '90s and 2.7 since 1899.

## FIRE INSURANCE STATISTICS.

TABLE No. 1.—ALARMS, EXTENT OF FIRES, INSURANCE LOSS.

| Year. | Alarms. | Fires. | | | | | Loss Insured. | Average Insurance Loss per Fire. |
|---|---|---|---|---|---|---|---|---|
| | | Total Number. | Confined to Place of Origin. | Confined to One Floor. | Extended to Adjoining Buildings. | Extended Beyond Adjoining Buildings. | | |
| 1900... | 6,334 | 5,499 | 5,253 | 5,184 | 246 | ..... | $5,813,599 | $1,094 |
| 1901... | 6,185 | 5,519 | 5,458 | 5,151 | 61 | 50 | 5,383,831 | 975 |
| 1902... | 6,328 | 5,640 | 5,307 | ..... | 333 | ..... | 3,555,064 | 759 |
| 1903... | 7,353 | 6,563 | 5,802 | 5,445 | 761 | 688 | 4,017,919 | 635 |
| 1904... | 8,480 | 7,549 | 7,468 | 6,304 | 81 | ..... | 4,343,905 | 600 |

Authority: Committee on Statistics, National Board of Fire Underwriters.

TABLE No. 2.—FIRES, INSURANCE AND LOSSES.

| Year. | Fires. | | | | Insurance. | | |
|---|---|---|---|---|---|---|---|
| | Total Number. | Fires in Buildings. | Extended only to Adjoining Buildings. | Extended beyond Adjoining Building. | Buildings. | Contents. | Buildings and Contents. |
| 1900..... | 5,165 | 5,023 | 102 | 43 | $44,881,662 | $20,642,944 | $65,524,606 |
| 1901..... | 4,719 | 4,580 | 82 | 37 | 40,888,809 | 30,433,678 | 71,322,487 |
| 1902..... | 4,919 | 4,690 | 61 | 28 | 42,399,796 | 33,671,879 | 78,071,676 |
| 1903..... | 5,349 | 5,018 | 84 | 26 | 56,255,538 | 22,008,708 | 78,264,246 |
| 1904*..... | ..... | ..... | .... .... | ..... | 62,248,350 | 23,777,552 | 86,025,902 |

| Year. | Losses (Insured). | | | | |
|---|---|---|---|---|---|
| | Buildings. | Contents. | Buildings and Contents. | Exposure Losses. | Average Insurance Loss Per Fire. |
| 1900..... | $1,677,128 | $3,684,857 | $5,361,985 | $644,154 | $1,038 |
| 1901..... | 1,204,530 | 4,185,637 | 5,390,169 | 524,100 | 1,140 |
| 1902..... | 1,114,662 | 3,414,133 | 4,511,540 | 249,009 | 918 |
| 1903..... | 1,464,450 | 3,863,741 | 5,328,192 | 195,535 | 997 |
| 1904..... | 1,778,349 | 4,621,665 | 6,400,014 | ..... ... | ..... |

* Complete Data for 1904 not printed.
Authority: Fire Patrol Reports, New York Board of Fire Underwriters.

## FIRE DEPARTMENT STATISTICS.

### TABLE No. 3.—FIRES, INSURANCE AND LOSSES.

| Year. | Total Fires. | Insurance, Buildings and Contents. | Losses. | | | | | | Average Gross Loss per Fire. |
|---|---|---|---|---|---|---|---|---|---|
| | | | Gross. | | | Insured. | | | |
| | | | Buildings. | Contents. | Buildings and Contents. | Buildings. | Contents. | Buildings and Contents. | |
| 1900 | 5,711 | $133,382,491 | $2,032,146 | $3,982,540 | $6,014,686 | $1,983,321 | $3,830,278 | $5,813,599 | $1,095 |
| 1901 | 5,743 | 147,990,500 | 1,712,187 | 3,868,648 | 5,580,835 | 1,606,458 | 3,626,624 | 5,233,082 | 1,010 |
| 1902 | 5,840 | 158,768,415 | 1,524,249 | 2,758,762 | 4,283,111 | 1,206,076 | 2,348,888 | 3,555,064 | 760 |
| 1903 | 6,784 | 177,685,561 | 1,236,149 | 2,928,809 | 4,164,958 | 1,208,274 | 2,809,635 | 4,017,909 | 615 |

Note: Fire Department report for 1904 not published.
Authority: Fire Marshal's Records, Manhattan and The Bronx, New York Fire Department.

### ALARMS AND FIRES, 1903.

#### HOW SIGNALLED.

| | |
|---|---|
| By street boxes, ordinary | 5,008 |
| By street boxes, auxiliary | 55 |
| Automatic Fire Alarm Co. (Automatic) | 110 |
| Consolidated Fire Alarm Co. (Automatic) | 78 |
| Special Fire Alarm Electrical Signal Co | 14 |
| By Public Telephone | 52 |
| From Police Headquarters | 10 |
| Stills and Miscellaneous | 2,247 |
| Total | 7,574 |

#### NATURE OF ALARMS.

| | |
|---|---|
| Alarms for fires | 6,784 |
| Alarms for indications of fire | 268 |
| False or unnecessary alarms (box and stills) | 401 |
| False or unnecessary alarms (automatic) | 121 |
| Total | 7,574 |

#### HOW EXTINGUISHED.

| | |
|---|---|
| Without engine streams | 4,258 |
| With one engine stream | 1,915 |
| Two or 3 engine streams | 462 |
| Several engine streams | 149 |
| Total | 6,784 |

#### EXTENT OF DAMAGE.

| | |
|---|---|
| Less than $100 | 5,130 |
| $100 to $5,000 | 1,536 |
| $5,000 to $100,000 | 114 |
| Over $100,000 | 4 |
| Total | 6,784 |

# FIRE-FIGHTING FACILITIES.

## WATER SUPPLY.

**OWNERSHIP.**—The Boroughs of Manhattan and The Bronx are supplied with water from works owned and operated by the municipality.

Previous to 1842 the only supply was by pumpage from wells, but in that year water from the Croton river was delivered through the Croton aqueduct. This source of supply has since been developed by the construction from time to time of various impounding and distributing reservoirs and of the New Croton aqueduct in 1890. In 1884, a small part of the watersheds of the Bronx and Byram rivers was brought into service in an emergency, water being taken to the city through a 48-inch pipe.

**ORGANIZATION.—General.**—Works are now under the control of the Department of Water Supply, Gas and Electricity, with the exception of the construction of new supply works. Development of the Croton watershed and construction of Jerome Park reservoir are in charge of the Aqueduct Commission; and in May, 1905, an act of the State legislature created a Board of Water Supply to provide an additional supply for the city.

**Personnel.**—*Department of Water Supply, Gas and Electricity.*—The single Commissioner of Water Supply, Gas and Electricity is appointed by the mayor for an indefinite term, and he appoints five deputies having direct supervision in their respective boroughs. Present officials for Manhattan and The Bronx, no one of whom had experience in water works management previous to appointment, are as follows:

| | Date of Appointment. |
|---|---|
| Commissioner, John T. Oakley | Jan. 1, 1904 |
| Deputy Commissioner, Frank J. Goodwin, Manhattan | Jan. 1, 1904 |
| Deputy Commissioner, Thos. W. O'Neil, The Bronx | Jan. 4, 1904 |

The work of the department is conducted by division into bureaus, the number of these and the scope of their work differing with conditions in the several boroughs.

Bureaus conducting work of the department in Manhattan are those of Chief Engineer, Water Register, Lamps and Gas, and Electricity.

The Bureau of Chief Engineer has in charge the operation, maintenance and extension of the water supply system. The head of this bureau is appointed by the commissioner, and holds office at his pleasure; present Chief Engineer, Mr. I. M. de Varona, was appointed April 1, 1905, and is also chief engineer for the other boroughs of the city. He is a graduate of Rensselaer Polytechnic Institute, 1863, a member of the American Society of Civil Engineers, and has been connected with the Brooklyn water department for 23 years, since 1902, as chief engineer.

Consulting Hydraulic Engineer George W. Birdsall has been connected with the department since 1872, at various times as chief engineer, and has an intimate knowledge of the system.

Under the bureau are at present eight divisions, though a reorganization is contemplated.

Division of engineering, in charge of chief engineer, includes drafting room and assistant engineers assigned to special duties.

County division, in charge of Principal Assistant Engineer John E. McKay, includes care and operation of all storage and distributing reservoirs and gate houses, measurement of flow of water, sanitary patrol, etc., for Manhattan and The Bronx.

Division of pipes and distribution, Assistant Engineer Charles H. Bull has charge of installation and maintenance of pipes, hydrants and valves in Manhattan and The Bronx.

Mechanical division, Assistant Engineer John W. McKay, is "responsible for the safe, economical and efficient operation of all pumping stations" in the city, with the exception of those in Brooklyn.

General inspection division has in charge only the inspection of pipe laying contracts and the general work of three "floating" gangs in Manhattan and The Bronx.

There are also the divisions of complaints and services and of accounting.

The number of men employed on maintenance in Manhattan and The Bronx is 675, of which number 240 are in the county division, 285 in the division of pipes and distribution, and 95 in the mechanical division.

*Aqueduct Commission.*—The Aqueduct Commission was created by act of the Legislature in 1883, and as at present constituted consists of Mayor McClellan and Comptroller Grout, *ex officio*, and four commissioners, John F. Cowan, president; William H. Ten Eyck, John J. Ryan and John P. Windolph, appointed by the mayor, term to cease on completion of work.

Acting Chief Engineer Walter H. Sears was appointed as such in August, 1905, and is assisted by five division engineers and a corps of assistants.

*Board of Water Supply.*—The Board of Water Supply as appointed by the mayor in

June, 1905, consists of three commissioners: J. Edward Simmons, president; Charles A. Shaw and Charles M. Chadwick; term of office indefinite.

In August, 1905, J. Waldo Smith was appointed chief engineer, with John R. Freeman, William H. Burr and Frederic P. Stearns as the consulting engineers. The engineering staff is in process of organization and preliminary work is actively under way, looking toward the development of the Ulster county watersheds, as recommended by the Burr-Hering-Freeman Commission.

**Records.**—Records and plans relating to the distribution system were, until recently, very incomplete and in some respects almost entirely lacking. In 1902, a set of record plans with tracings of same was prepared, showing general location of mains, gates and hydrants; these have been found grossly incorrect in some particulars, and no systematic attempt has been made to keep them up to date. The present chief engineer has caused to be made accurate field surveys, from which are being prepared large scale plans showing exact locations of mains, gates and hydrants, type of hydrants and date of installation of mains so far as is possible from incomplete earlier records.

A systematic record of condition of gate valves, begun in 1902, has been neglected for about a year past.

Field books and plans are well arranged and indexed; plans of earlier works are incomplete.

Reports and records of pumping service, consumption and pressures have not been kept in form convenient for ready reference and study. However, notable improvement in this respect has been made by the present chief engineer.

Records and plans of the Aqueduct Commission are in the main complete, well arranged and indexed.

**Quarters.**—Main offices of the Department of Water Supply, Gas and Electricity are in the Park Row building, with headquarters for the county division at High Bridge, and local quarters for the several divisions of maintenance of supply works and for the repair gangs in the city. Pipe yards at East Twenty-fourth street and East River and at One Hundred and Fortieth street and Harlem River.

All offices and quarters are connected by telephone, those above High Bridge being on a private line, others on public circuits.

**Fire Alarms.**—No fire alarms ring in any of the offices or quarters of the department. Employees do not attend fires as a part of their regular duties.

**Expenses.**—Expenditures for water works for the past five years as furnished by the Department of Water Suply, Gas and Electricity have been as follows:

| Year. | Maintenance. | New Work. | Total. |
|---|---|---|---|
| 1900 | $844,088 | $74,381 | $918,469 |
| 1901 | 1,130,146 | 449,068 | 1,579,214 |
| 1902 | 1,081,479 | 1,179,912 | 2,261,391 |
| 1903 | 685,025 | 3,211,945 | 3,896,970 |
| 1904 | 969,504 | 1,521,576 | 2,491,080 |

The above does not include interest and sinking fund, nor expenditures by the Aqueduct Commission.

**GENERAL OUTLINE OF SYSTEM.**—The sources of supply are the Croton, Bronx and Byram rivers, developed by the construction of storage reservoirs. From the lowest storage reservoirs conduits convey water by gravity to distributing reservoirs in the city. There are two aqueducts from the Croton river, both of which will ultimately discharge into the distributing reservoirs at Jerome Park and Central Park after supplying High service pumping stations for Manhattan and The Bronx. Since December, 1896, the Old aqueduct has been shut off just north of Jerome Park reservoir to make changes involved in construction of this reservoir; and carries enough water to supply only Jerome Park pumping station and the Low service in The Bronx. A connection with the New aqueduct at Dunwoodie allows prompt regulation of this supply. The Borough of Manhattan is thus entirely dependent on the New Croton aqueduct for its supply, distribution being made partly from the One Hundred and Thirty-fifth street gate house and partly from Central Park reservoir.

From The Bronx and Byram system of reservoirs water flows by gravity through a 48-inch pipe line into the Williamsbridge distributing reservoir, supplying the Williamsbridge service in The Bronx.

Distribution in Manhattan is by three services, known as the Low, Main High and Upper High services. The first is supplied by gravity from reservoirs in Central Park and the others from pumping stations.

There are also three services in The Bronx: The Low service supplied by gravity from Croton aqueducts, the Williamsbridge by gravity from Williamsbridge reservoir, and the High from Jerome Park pumping station.

Elevations in this report are in feet above mean sea level.

**SOURCE OF SUPPLY.—Drainage Area.**—Total area of Croton watershed above New Croton dam is 360.4 square miles, of which 16.2 square miles, or 4½ per cent., is water surface. The Bronx and Byram watersheds have a combined area of 22 square miles, of which 6 per cent. is water surface. Water-

sheds hilly, with about 10 per cent. woodland, and a large proportion cultivated land.

**Rainfall and Yield.**—The average rainfall in the Croton watershed for the 34-year period beginning 1868, was about 48 inches, with an average run-off of 23 inches, yielding about 1,000,000 gallons a day per square mile. Minimum rainfall was 37 inches, with a run-off of about 12½ inches, yielding 603,000 gallons a day per square mile.

It is estimated by John R. Freeman, civil engineer, that with the New Croton dam completed the utmost daily yield which can be relied upon in a series of years of low rainfall is 275,000,000 gallons per day; this may be increased by proposed additional storage reservoirs to 300,000,000 gallons.

The probable safe yield from The Bronx and Byram watersheds is estimated at about 15,000,000 gallons per day.

**Storage Reservoirs.**—*General.*—All completed reservoirs are under the supervision of the county division. They are maintained in good condition, and flow of water regulated by considerable forces of men stationed at various points in the watersheds.

There are on the Croton watershed 7 storage reservoirs in service besides the Cross River reservoir, construction of which has just been begun and the Croton falls proposed for construction; also a number of controlled ponds. On The Bronx and Byram watersheds are 4 storage reservoirs. Flow from upper reservoirs in each watershed is through natural channels to lowest reservoir. For details of reservoirs see Table No. 4.

*Croton System.*—New Croton Reservoir.—This reservoir is formed by building a dam about 3 miles above the mouth of the river and 3 miles below and submerging the Old Croton dam. Entirely of masonry, of substantial section, on rock foundation; total length, 2,168 feet, with spillway section 1,000 feet long; maximum height, 166 feet. There are two gate houses; No. 1 at the north end controlling waste pipes for drawing off the reservoir, and No. 2 at the south end designed to control the flow into the old aqueduct which passes through the dam at this point; elevation of invert, 151.8. Near the Old Croton dam is built a gate house controlling at present the flow into both aqueducts, but which after the completion of the New Croton dam will be used for the New aqueduct alone. Elevation of invert of New aqueduct at this point, 139.1. Keepers on duty at all times.

West Branch or Carmel Reservoir.—Near Carmel, N. Y. Formed by the construction of two dams. Main dam 1,800 feet long, maximum height 65 feet; central masonry spillway 260 feet long, founded on rock, flanked on either side by an earth dam with masonry core wall; embankment 15 feet wide on top, inner slope paved, top and outer slope sodded. At north end of spillway is gate house on rock foundation, with two 2x5 foot sluice gates controlling the flow into two 48-inch outlet pipes.

About one mile southwest of the main dam is an auxiliary dam across the valley of a small tributary to the West branch. Dam is of earth, 22 feet wide on top, with masonry core wall founded on rock and of construction similar to that of the earthen portions of the main dam; 800 feet long, maximum height 50 feet. Gate house in the center of the dam on line of the core wall, with one 2x5 foot sluice gate regulates discharge into a 36-inch outlet pipe.

East Branch Reservoir.—This reservoir, located near Brewster, Putnam County, is a double one, consisting of the Sodom and the Bog Brook reservoirs, connected by a tunnel 10 feet in diameter and 1,778 feet long to equalize the supply received by each.

The Sodom reservoir was formed by constructing a dam having a masonry section 500 feet long, maximum height 78 feet; an earth section with masonry core wall, 600 feet long, and a masonry overfall section 500 feet long and about 8 feet high. In the up-stream face, near the center of the masonry section, is the gate house, into which water can be drawn either at middle depth or at the bottom through two 2x5 foot sluice gates, and discharged through two 48-inch pipes.

The Bog Brook reservoir was formed by building two earthen dams: One is 25 feet wide on top, 1,340 feet long, maximum height 60 feet, with masonry core wall founded partly on rock and partly on hard-pan; the other is 12 feet wide on top, 1,956 feet long, maximum height 24 feet, with core wall founded on hard-pan. Both dams have inner slope paved and outer slope sodded in the usual manner. The outflow is regulated at a gate house located near the middle of the first dam. Water admitted over a weir at the surface, or through 36-inch pipes, one at mid-depth supported by a rubble masonry pier and one at the bottom laid on solid rock; flow regulated by a 2x5 foot sluice gate at each point, and water discharged through 36-inch pipe laid in brick tunnels. Neither dam has a spillway, but a waste weir is provided in a gate house, near the north portal of a tunnel through which water may waste into Sodom reservoir.

Amawalk Reservoir.—This reservoir, located on the Muscoot river near Amawalk, Westchester County, is formed by constructing a main dam and an auxiliary dam west of it. Both are of earth with masonry core walls, slopes treated in the usual manner. Main dam is 1,270 feet long, 50 feet wide on top, with a maximum height of 80 feet; there is also a

guard wall about 300 feet up-stream from the main core-wall; auxiliary dam has a length of 400 feet, top width of 25 feet and maximum height of 20 feet. Fifty foot spillway near the foot of the inner slope of main dam. Two lines of 30-inch mains laid in a brick tunnel conduct the water to a gate house near the toe of the outer slope, and from there four lines of 20-inch pipe lead to a fountain-basin below the dam.

Titicus Reservoir.—This reservoir is located near the village of Purdy's, in Westchester County. Dam consists of a masonry section 534 feet long, including a 200 foot spillway, and of earth sections with masonry core walls on the north and south, aggregating 985 feet in length. Maximum height of masonry section 109 feet, and of earth section 102 feet; top width 30 feet, core wall founded partly on rock and partly on earth and slopes treated as in others of the earth dams. Flow from reservoir is regulated at a gate house on the up-stream face of the masonry section, near the spillway. There are two separate inlet chambers, each having three openings 6x9 feet, at varying depths, and two 2x5 foot sluice gates into corresponding outlet chambers from which two 48-inch pipes, with gates, lead through the dam.

Middle Branch Reservoir.—Situated in the town of Southeast, Putnam County. Formed by constructing an earth dam with masonry core wall, 515 feet long, with maximum height of 94 feet.

Boyd's Corner Reservoir.—Located in the town of Kent, Putnam County. Formed by building a masonry dam across the west branch of the Croton river. Dam is founded on rock. 670 feet long, maximum height 57 feet, and reinforced by an earth bank 20 feet wide on top built against the up-stream face. Water drawn from the reservoir through two 36-inch pipes passing through the dam, their inlets controlled by gates placed in a tower; 100 foot overflow at northeast end excavated in rock.

Cross River Reservoir.—This reservoir, near Katonah, is to be formed by the construction of a masonry dam 865 feet long, maximum height 160 feet, with waste weir 240 feet long. A contract for its construction was signed in

TABLE No. 4.—STORAGE RESERVOIRS.

| System. | Name. | Constructed. | Elevation, High Water Line. | Available Capacity, Million Gallons. | Area in Acres. | Area of Tributary Watershed, Sq. Mi. | Available Depth, Feet. |
|---|---|---|---|---|---|---|---|
| Croton | New Croton | 1906 | 199 | 31,500 | 3,411 | 180.9 | 47 Old aqueduct.<br>60 New " |
| | West Branch (or Carmel). | 1895 | 502 | 10,070 | 1,000 | 19.5 | 47 |
| | East Branch. Bog Brook. | 1891 | 416 | 4,295 | 410 | 73.4 | 34 Tunnel.<br>49.5 By-Pass. |
| | East Branch. Sodom | 1891 | 416 | 5,093 | 576 | 3.5 | 63 |
| | Amawalk | 1897 | 404 | 6,692 | 602 | 18.32 | 64 |
| | Titicus | 1893 | 324 | 7,167 | 704 | 22.80 | 75 |
| | Middle Branch | 1878 | 371 | 4,005 | 429 | 20.51 | 48 |
| | Boyd's Corners | 1873 | 592 | 2,727 | 282 | 21.43 | 56 |
| | Cross River | Under construction. | 329 | (9,000) | | | |
| | Croton Falls | Proposed. | | (14,000) | | | |
| | Controlled Ponds— | | | | | | |
| | Lake Mahopac | 1870 | 659 | 575 | 562 | 2.50 | 5 |
| | Lake Kirk | 1870 | 582 | 565 | 102 | 2.00 | 18 |
| | Lake Gilead | 1870 | 496 | 380 | 122 | 0.60 | .. |
| | Lake Gleneida | 1870 | 504 | 165 | 179 | 0.30 | .. |
| | White Pond | 1899 | 825 | 200 | 115 | 0.90 | .. |
| | Barrett's Pond | 1870 | 778 | 170 | 70 | 0.50 | .. |
| Bronx | Kensico | 1884 | 246 | 1,600 | 250 | 13.67 | 30 |
| | Rye | 1884 | 301.5 | 1,300 | 320 | | 16 |
| Byram | Byram Lake | 1897 | 450 | 800 | 190 | ..... | 20 |
| | Byram Diversion Dam | 1897 | ..... | 100 | ..... | 8.33 | |

Total storage capacity in Croton system, not including Cross River and Croton Falls Reservoirs.....73,600 million gallons.
" " " " Bronx and Byram systems..... 3,800 " "
" additional storage obtainable by use of flash-boards at certain reservoirs in Croton system, estimated at..... 2,000 " "

June, 1905; work to be completed in 26 months. The contractor has his plant on the ground and construction was under way, but further work is at present prevented by injunction.

Controlled Ponds.—The controlled ponds in the Croton watershed, noted in Table No. 4, are owned by the city and there are several others from which water has been drawn at times by special agreement. These have been utilized by cutting down their outlets and building dams across the same, water being drawn through cast-iron pipes.

*Bronx and Byram Systems.*—The Bronx river watershed is developed by the construction of a dam near Kensico station, and one at the outlet of Little Rye pond, converting the two Rye ponds into one lake. Water from Rye lake flows by the natural channel into Lake Kensico, and from the dam at Lake Kensico into the 48-inch Bronx pipe line. Both dams are of earth, that at Kensico having a gate house at the up-stream toe, from which a 48-inch main laid in a brick tunnel leads through the dam and is controlled also by gates at the down-stream toe.

On the Byram watershed water flows from Byram lake through a natural channel to the reservoir formed by the Byram Diversion dam, from which leads a tunnel into The Bronx watershed above Lake Kensico.

These works are small and comparatively unimportant.

**Main Supply Conduits.**—*Old Croton Aqueduct.*—Conveys water from Croton lake to the One Hundred and Thirty-fifth street gate house, thence by pipes or masonry conduits to Central Park reservoirs, a total distance of about 38 miles. Completed in 1842, is 7½ feet wide by 8 feet high, area of cross-section about 53 square feet, grade in general 1.109 feet per mile; capacity about 80 million gallons per day. There are 16 lined tunnels in earth and rock, aggregating 6,841 feet in length, the remainder of the masonry section in trench or on embankment; for the greater part of the length the arch is of 8-inch brick work, side walls and invert of concrete or rubble with brick lining. There are a number of culverts and bridges, including the masonry bridge of 88-foot span across Sing Sing Kill and "High Bridge" across the Harlem river, 1,450 feet in length, with 15 arches of 50 and 80 foot span; water is carried across the bridge through one 90-inch and two 36-inch pipes. Extensive repairs have been made at various times, generally on account of settling of embankments of loose rock, and the aqueduct is at present being strengthened and repaired. Gate houses and appurtenances generally in good condition.

*New Croton Aqueduct.*—Conveys water from Croton lake to the One Hundred and Thirty-fifth street gate house, a distance of about 31 miles, thence by pipe lines to New Central Park reservoir and the distributing system. Completed in 1890. Capacity about 290 million gallons daily. A little over a mile is built in trench, the remainder in limed rock tunnel, of which the upper end, with the exception of Gould's swamp siphon, is of horseshoe section, of capacity equal to that of a circular conduit 14 feet in diameter under uniform grade of 0.7 feet per mile; about 7 miles at the lower end is under pressure, forming a long inverted siphon of circular section, 12 feet 3 inches in diameter, except under the Harlem river, where it was reduced to 10½ feet to increase the velocity and prevent deposit of silt. Aqueduct and appurtenant structures in good condition.

*Bronx Pipe Line.*—A 48-inch cast-iron pipe conduit, completed in 1884, 15.2 miles in length from Kensico reservoir to Williamsbridge distributing reservoir. Average head 50 feet, estimated capacity 22 million gallons per day.

**CONSUMPTION.—Average.**—The approximate average consumption of water in the Boroughs of Manhattan and The Bronx during the last five years from data obtained from the Department of Water Supply, Gas and Electricity, together with the approximate population and per capita consumption, are shown in Table No. 5.

TABLE NO. 5.—CONSUMPTION.

| Year. | Approximate Average Daily Consumption, Gallons. | Population. | Gallons per Capita. |
|---|---|---|---|
| 1900 | 269,000,000 | 2,050,600 | 131 |
| 1901 | 275,000,000 | 2,117,300 | 130 |
| 1902 | 282,000,000 | 2,184,100 | 129 |
| 1903 | 288,000,000 | 2,250,800 | 128 |
| 1904 | 313,000,000 | 2,317,600 | 135 |

Per capita consumption in the table is based on the approximate resident population. The Burr-Hering-Freeman report on additional supply, dated 1903, gives 600,000 as the estimated non-resident population in Manhattan. Assuming it to be the same for 1904, the approximate total number of water users would be 2,917,600, and the gallons per capita of actual users 107. Per capita consumption in New York is smaller than in several other of the largest cities in the United States.

**Maximum and Minimum.**—Measurements show that the maximum rate of consumption occurs at about 10 A. M., at which time it is about 19 per cent. above the mean rate for the day. The minimum rate occurs at about 3 A. M., and is about 82 per cent. of the mean.

A study of the monthly averages for the last five years shows the consumption of no one month continually above the others. By averaging the monthly amounts for the last five years, December leads, closely followed by September and August. No reliable records showing the daily consumption. The daily average of the highest month is 326,000,000 gallons in December, 1904.

**In Different Services.**—No good records of the amounts used in the different services have been kept. The following figures, based on the best available data, show the approximate amounts:

| District. | Consumption in Million Gallons per Day, 1905. |
|---|---|
| Manhattan Low service | 216 |
| Manhattan Main High service | 54 |
| Manhattan Upper High service | 5 |
| Total, Manhattan | 275 |
| Bronx Low service | 11 |
| Williamsbridge service (The Bronx) | 18 |
| Bronx High service | 9 |
| Total, The Bronx | 38 |
| Total, Manhattan and The Bronx | 313 |

**Measurement.**—Consumption records are based on measurement of flow through the Old and New Croton aqueducts and The Bronx pipe line. Flow in the aqueducts is determined from depths of water flowing as recorded at various gaging stations, by the use of tables of quantities at different depths computed from current meter measurements of velocities. Quantity flowing through The Bronx pipe line is determined from a discharge diagram based on pitometer measurements; the value of the diagram is questionable owing to some of the conditions prevailing during the experiments. The quantity discharged by the aqueducts for a given depth is dependent upon the condition of foulness of the interior surface, and measurements to determine the correction to be applied for this effect have been taken at too long intervals for accurate computation of flow. Some of the other methods of measurement are crude and the results in general are inaccurate. On this account the figures for consumption given above can be considered as approximate only.

An assistant to the chief engineer has recently been placed in charge of computations on consumption with the intention of making them complete and accurate.

**Use of Meters.**—About 20 per cent. of all taps are metered. This is reported to include all railroads, shops, hotels, large office buildings, etc. The law allows the commissioner to place meters at his discretion on practically all services except those supplying private dwellings. They are installed and maintained at the expense of the consumer. Residences are not metered except at the request of the owner. Meter rates are so adjusted as to discriminate against the use of meters.

**Waste and Leakage.**—The question of waste and leakage has been repeatedly investigated. Mr. John R. Freeman, civil engineer, in his report to the comptroller, dated March 23, 1900, estimates the total needless waste and leakage as at least one-half of the total amount supplied, and in another part of the report says, "It is dangerous to be too hopeful about preventing a large part of the waste, for with these hopes unfulfilled and reservoirs emptied, disaster would be beyond remedy."

The Burr-Hering-Freeman report to the Commissioner of Water Supply, Gas and Electricity, dated November 30, 1903, states that, "The waste has been investigated and found largely due to defective plumbing and fixtures. The leakage from street mains is found to be less than heretofore supposed. This problem of the amount and distribution of the water waste is an extremely difficult one and it is recommended that these investigations be continued and extended by permanently districting the city for this purpose and ascertaining the inflow and outflow for each district, and that the cause of the large night flow be more fully investigated." Again, this report says, "The house to house inspection in typical districts in the Manhattan and The Bronx boroughs indicates that the loss from leaky and defective plumbing fixtures probably exceeds fifteen per cent. of the total supply, or upward of 40,000,000 gallons per day."

**PRESSURES.**—Recording gages are located in headquarters of six repair companies in different sections of the city; five gages in operation. Records from gages show that the pressure at Worth street on the Manhattan Low service is about 10 pounds lower at 10 A. M. than at 3 A. M. Another gage at Eighty-seventh street on the same service, but much nearer the Central Park reservoir, shows a variation of 5 pounds between extremes. Two gages on the Williamsbridge service in The Bronx show 10 and 4 pounds, respectively, between extremes and one on The Bronx High service shows a variation of 8 pounds. The records from these gages are not properly filed and many are reported lost.

In May and June, 1905, pressure readings were taken by National Board engineers at 1,931 hydrants well distributed throughout the Boroughs of Manhattan and The Bronx. All observations were taken between the hours of 9 A. M. and 5 P. M. Results of observations are given in Table No. 6 and pressure conditions are shown graphically on accompanying plan No. 2.

TABLE No. 6.—PRESSURES AT HYDRANTS.

| District. | Pressure Pounds per Square Inch With Hydrant Outlets Closed. | | | Remarks. |
|---|---|---|---|---|
| | Average. | Maximum. | Minimum. | |
| Manhattan Low service.... | 26 | 42 | 7 | |
| Manhattan High service... | 35 | 50 | 13 | |
| Manhattan Upper High service..... | 67 | 130 | 31 | |
| Bronx Low service ..... | 33 | 51 | 9 | |
| Williamsbridge service..... | 38 | 66 | 15 | Bronx |
| Bronx High service..... | 49 | 66 | 21 | |

In a general way, the pressures in Manhattan below Fifty-ninth street range from 15 to 30 pounds, those above Fifty-ninth street from 30 to 40 pounds, with a few on the Manhattan Upper High service running over 100 pounds, and those in The Bronx from 30 to 50 pounds. In the district below Fifty-ninth street from 10 to 20 pounds pressure is lost by friction in the pipes from the ordinary daily draught on the system.

**DISTRIBUTING RESERVOIRS AND STANDPIPES.—General.**—All distributing reservoirs and gate houses, except those at High Bridge, in Manhattan and The Bronx are in charge of a head gate-keeper, who has a force of about 25 men. He resides on the grounds of the Old Central Park reservoir. Details of reservoirs and standpipes are given in Tables Nos. 7 and 8.

In general, condition of gate houses is satisfactory, though lighting facilities are poor. Sluice gates and valves are of an old type, but where depended upon are serviceable and in general are in good condition.

**Old Central Park Reservoir.**—Between Seventy-ninth street and Eighty-sixth street, 1,826 feet long by 836 feet wide. Dam is an earth embankment with puddle core wall, 18 feet wide on top, maximum height 38 feet. Outside face protected by stone walls, and inner slopes paved. An earth embankment divides the reservoir into two parts, connected by a 30-inch pipe.

Inlet from Old aqueduct is at gate house near northwest corner, arranged to deliver water into either or both basins. Outflow through masonry tower on east side of each basin, and on west side of south basin into distributing mains of Manhattan Low service; controlled by valves on mains, in fair condition; sluice gates in all outlet chambers are practically worthless and no dependence is placed upon them. Reservoir and most of the appurtenances are serviceable and in fair condition.

TABLE No. 7.—DISTRIBUTING RESERVOIRS.

| Name of Reservoir. | Constructed. | Elev. High Water Line. | Available Capacity, Million Gallons | Depth in Feet. | Area in Acres | No. and Size of Inlets. | Elev. of Inlets (Bottom). | No. and Size of Outlets. | Elev. of outlets (Bottom). | No. and Size of Blow-Offs. | Elev. of Blow-Off. | Supplied from | Supplies | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Old Central Park | 1842 | 118 | 211 | 20–30 | 31 | One masonry conduit 7′ 5″ x 8′ 5½″ | 109.5 | 2–30″ 3–36″ | 87 | 5–12″ on pipes | 86 | New Croton Aqueduct. Connection at 135th St. with Old Aqueduct | Low Service, Manhattan | |
| New Central Park | 1862 | 118 | 1000 | 36 | 92 | One masonry conduit 7′ 5″ x 8′ 5½″ & 4–48″ | 109 | 6–48″ 2–48″ reduced to 2–36″ | 80 | 2–24″ | 74 | " | Low Service, Manhattan | |
| Williamsbridge... | 1889 | 193 | 140 | 37 | 12 | 1–48″ | 178 | 3–36″ | 157 | 1–12″ | 159.5 | Bronx pipe line, 48″ | Williamsbridge, Service | |
| High Bridge | 1870 | 219 | 11 | 16 | 7 | 2–20″ | 222 | 2–36″ reduced to 2–20″ | 200 | 1–36″ | 203 | Pumpage from Old or New Croton Aqueducts | Main High Service. | Equalizer High Service Manhattan |
| Jerome Park | Under construction | 134 | E 1110 W 750 — 1860 | | | To have connections from Old and New Aqueducts | 121 | 17–48″ | 105 | | | Old and New Aqueducts | Low Service, Manhattan and Bronx | |

**New Central Park Reservoir.**—Between Eighty-sixth and Ninety-fifth streets, on the site of a natural basin of irregular shape. Dam is of earth, 15 feet wide on top, of moderate height; puddle core wall founded throughout on rock; inner slopes paved with stone laid in mortar, top and outer slopes sodded. A central embankment constructed in a similar manner except that it is entirely covered with paving, forms an eastern and western division.

The North gate house at the end of the dividing wall admits water from a branch of the Old aqueduct, and also contains gates and connections for four lines of 48-inch service mains, of which two are in use. The New gate house at the north end of the east basin admits water through four 48-inch mains from the New aqueduct. The South gate house at the end of the dividing wall discharges water through six 48-inch mains to the Manhattan Low service. Reservoir and appurtenances in good condition.

**Williamsbridge Reservoir.**—Located in the north central part of The Bronx, west of The Bronx river. Dam is of earth with masonry core wall, inner slope paved, top and outer slope sodded. Inlet and outlet gate houses contain sluice gates and valves on mains. In good condition and well maintained. Keeper lives near by and has telephone connection.

**High Bridge Reservoir.**—Located near the west end of High Bridge, across the Harlem river, and serves as an equalizer for the Main High service. Dam is of earth with puddle core wall, paved on inner slope with stone laid in cement. Inlet and outlet gate houses over regulating gates. In good condition; no apparent leakage.

**Jerome Park Reservoir.**—Located near Kings Bridge station, in the northwest part of The Bronx. Contract for this reservoir was made in 1895, but it is still under construction. Largely in excavation, with earth embankments containing masonry core walls, generally of moderate height, maximum 35 feet. Bottom and inner slopes lined with concrete, upper portion of slopes faced with stone paving. A masonry structure founded on rock and supporting both the Old aqueduct and a branch from the New aqueduct, divides the reservoir into an east and a west basin, and flow into and from the reservoir is to be controlled by a system of 7 gate houses.

**Standpipes.**—Supplied by pumpage from Low service supplies. All essential details noted in Table No. 8.

**PUMPING STATIONS.—General.**—About 22 per cent. of the total supply is pumped to High services at three pumping stations described below. One auxiliary station of small capacity in reserve.

**One Hundred and Seventy-ninth Street Pumping Station.**—*General.*—Located between Amsterdam avenue and Harlem River on One Hundred and Seventy-ninth street. Supplies both Main High service and Upper High service by direct pumpage. Supply drawn under 12 pounds pressure from Shaft No. 25, New Croton aqueduct.

*Equipment.*—Two 15,000,000 gallon pumps installed in 1903, and two 10,000,000 gallon pumps installed in 1897, pump through an equalizing standpipe into the Main High service; and two 4,000,000 gallon pumps supply the Upper High service, with High Bridge tower as equalizer. As the Upper High service consumption is only about 5,000,000 gallons per day, the excess pumpage overflowing High Bridge tower into High Bridge reservoir supplements supply for Main High service. Total rated capacity of station, 58,000,000 gallons per day; ordinarily one 15,000,000 gallon pump in reserve.

TABLE No. 8.—STANDPIPES.

| Name of Standpipe. | Constructed | Elev. of High Water Line. | Dimensions. | No and Size of Inlets. | No. and Size of Outlets. | Size of Overflow | Supplies. | Remarks. |
|---|---|---|---|---|---|---|---|---|
| High Bridge Tower. | 1872 | 324 | Steel tank 47,000 gals. capacity. | 1—20" | 1— 6" | 1—12" | Upper High Service Manhattan. | Overflows into High Bridge Reservoir. The tank has a combination of outlets and inlets. Those given are the ones now in use. |
| 179th St. | 1896 | 225 | 134' high. 6' in diam. | 2—36" | 1—48" | None. | High and Upper High Services. Manhattan. | To be raised 15 feet. Cast iron base. Soft steel plates, ⅜"–½" in thickness. |
| 98th St. | 1880 | 219 | 170' high. 6' in diam. | 1—36" | 1—36" | None. | High Service, Manhattan. | Boiler iron, ⅜"–½" in thickness. |
| Jerome Park. | 1905 | 303 | 185' high. 6' in diam. | 1—48" | 1—48" | None. | High Service, Bronx. | Soft steel plates, 1"–⅜" in thickness. |

Boilers in three batteries; one battery ordinarily in reserve. Steam piping not fully in duplicate. For details of pumps and boilers see Table No. 9.

*Operating Force.*—In three shifts; at least fourteen men in each. Two extra men in boiler room on day shift; machinist employed from time to time.

*Construction.*—Pump house, 60 by 75 feet, one story and basement, 26 feet to eaves. Walls of brick, with peaked iron roof on iron trusses, window frames of metal. Boiler room, 55 by 165 feet, of similar construction and separated from engine room by brick wall with one unprotected opening. Engine room floors of tile; basement and boiler room floors cement. Entire building of fireproof construction.

*Hazards.*—Station in good condition. No exposures. Boilers well set with substantial iron breechings or brick flue into brick chimney. Lighting by gas; also four locomotive headlights in boiler room and four in engine room. Wooden closets, lockers and work benches in basement, and wooden lockers in boiler room. Oils in wooden barrels in basement in considerable quantities. Oily waste kept in iron can; burned when emptied.

*Protection.*—One chemical extinguisher in boiler room and one in basement.

*Fuel.*—Coal supplied under contract; contractor under bond. Usually about 60 days' supply on hand. Supply received at wharf, where barges unload into a shaft connected with tunnel to pumping station.

**Ninety-eighth Street Pumping Station.**—*General.*—Located between Ninety-sixth and Ninety-eighth streets, west of Columbus avenue, and supplements the One Hundred and Seventy-ninth street station in supplying the Main High service. Supplied from 36-inch branch leading from New Croton aqueduct, near New Central Park reservoir.

*Equipment.*—Two 7,500,000 gallon and one 10,000,000 gallon engines pump through equalizing standpipe directly into mains of the Main High service. Total capacity of station, 25,000,000 gallons per day. The two former pumps have been in service 25 years, but appear to be in good condition; the latter is now being thoroughly overhauled. Ordinarily all three pumps are operated.

Four return tubular low pressure boilers, 14 years old, and two internally fired high pressure boilers of comparatively recent installation; all in good condition.

*Operating Force.*—In three shifts; at least five men in each. One extra engineer and about 5 extra laborers on the day shift.

*Construction.*—Pump house, 50 by 98 feet, one story and basement, 26 feet to eaves. Walls of brick, with peaked slate and tin roof on wooden sheathing on wooden trusses with clear span. Boiler room, 50 by 100 feet, of similar construction, adjoins and is separated by brick wall extending to roof with single unprotected opening. Joisted wooden floor in pump room, cement and brick in basement and boiler room.

Coal storage house, located between Ninety-sixth and Ninety-seventh streets and communicating with boiler room by tunnel under Ninety-seventh street. No fire doors or draft-stops at either end of tunnel. One story, 50 by 200 feet; construction similar to boiler room. Built in 1879; in good condition.

*Hazards.*—Exposures rather severe from closely built 4 to 5 story joisted brick tenements; unprotected openings all sides both buildings. Boilers well set with good clearance and brick smoke flue or secure iron breeching to substantial brick stack. Lighting by gas; kerosene oil lamps for emergency. Lubricating and kerosene oils in three 150-gallon iron tanks in oil vault under sidewalk at side of tunnel, ordinary wooden door at opening to vault from tunnel; waste in wooden bin in this vault. Supply of lubricating oils in wooden barrels in coal house. Small portable repair forge in boiler room.

*Protection.*—Two standpipes in pump house and basement, two in boiler house and five in coal storage house, all either 2½ or 3-inch, supplied by 4-inch main and all have 50 feet of 2½-inch hose and nozzle attached at each connection. Three 3-gallon chemical extinguishers and three axes in pump house. Six street hydrants within 300 feet.

*Fuel.*—Anthracite coal. Furnished by contract and contractor under bond. Usually about 60 days' supply on hand.

**High Bridge Pumping Station.**—*General.*—Located at One Hundred and Seventy-fifth street at western end of High Bridge on bluff above Harlem River. At present out of service, but maintained for emergency calls. Pumps connected to High Bridge reservoir and High Bridge tower, and may supply either Main or Upper High services in emergency. Supply from Shaft No. 25, New Croton aqueduct.

*Equipment.*—One 6,000,000 gallon, one 5,000,000 gallon and two 500,000 gallon pumps. Total rated capacity of station, 12,000,000 gallons per day. The two large pumps supply High Bridge reservoir directly, and the two small ones pump through 7-inch main into High Bridge tower. Three return tubular boilers.

*Operating Force.*—Watchman, on day shift only, in summer. In winter, watchman on all shifts.

*Construction.*—Pump house, 35 by 60 feet, two stories and basement with underground

## TABLE No. 9.—PUMPING PLANTS FOR WATER WORKS.

### PUMPS.

| Station. | Number and Make. | Class. | Date of Manufacture. | Diam. in Inches. Steam Cylinders. | Diam. in Inches. Water Plunger. | Stroke, Inches. | Rev. per Min. | Pressure, Lbs. Steam. | Pressure, Lbs. Water. | Pipe Conn. Diam. Ins. Suct. | Pipe Conn. Diam. Ins. Disc. | Rated Capacity, Each, Gals. per Day. | Slip, Per Cent. | Condition. | No. of Shifts. | Least No. Men on Shift. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 179th St..... | 2 Blake | Vertical, triple expansion, crank and fly wheel, condensing. | 1895 | 15–27–42 | 11¾ | 40 | 28 | 150 | 97 | 20 | 20 | 4,000,000 | 2½ / 4 | Good. | | |
| | 2 Blake. | Ditto. | 1897 | 15–27–42 | 17½ | 40 | 27 | 150 | 48 | 30 / 20 | 30 / 20 | 10,000,000 | 0 / 4 | Good. / Fair. | 3 | 10 |
| | 2 Worthington. | Vertical, triple expansion, direct acting, duplex, condensing, | 1902 | 16–25–46 | 31 | 36 | 19 | 155 | 47 | 30 | 30 | 15,000,000 | 2 | Good. | | |
| 98th St..... | 2 Worthington.. | Low duty, horizontal compound, duplex, condensing. | 1880 | 21–36⅜ | 26 | 48 | 13 | 70 | 45 | 20 | 30 | 7,500,000 | 2 | Good. | 3 | 5 |
| | 1 Worthington .. | High duty, horizontal compound, duplex, condensing. | 1890 | 18–36 | 26 | 36 | 20½ | 130 | 50 | 20 | 24 | 10,000,000 | ..... | Good. | | |
| | 1 Worthington. | Ditto. | 1883 | 19¼–36⅜ | 24 | 36 | 16 | 60 | 47 | 20 | 20 | 6,000,000 | 2 | Good. | | |
| High Bridge. | 1 Delamater Iron Works. | Vertical, single acting bucket and plunger. | 1875 | 32 | 25½ | 72 | 15 | 60 | 47 | 30 | 20 | 5,000,000 | 15 | Fair. | 1 | 1 |
| | 2 Worthington. | Horizontal, plunger type, duplex condensing. | 1892 | 16 | 8½ | 10 | 60 | 60 | 100 | 6 | 5 | 500,000 | 1 | Good. | | |
| Jerome Park... | 2 Worthington. | High duty, vertical, triple expansion, duplex, condensing. | 1905 | 16–25–48 | 25 | 37 | 22 | 155 | 70 | 24 | 24 | 10,000,000 | ..... | (New.) | 3 | 4 |

### BOILERS.

| Station. | Number and Make. | Type. | Date of Manufacture. | Grate Surface, Sq. Ft. | Heating Surface, Sq. Ft. | Rated Horse Power. | Steam Pressure. Max. Allowed. | Steam Pressure. Average. | Fuel. | Insurance. | Inspection. | Condition. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 179th St..... | 4 | Horizontal Tubular. | 1886 | 32 | 1,150 | 90 | 150 | 150 | Anthracite Coal. | None. | Police Dept. Annually. | Good. |
| | 4 Blake. | Ditto. | 1897 | 25 | 1,160 | 86 | 150 | 150 | | | | Good. |
| | 3 Cramp. | Internal Furnace. | 1903 | 30 | 990 | 100 | 160 | 150 | | | | Good. |
| 98th St..... | 4 Reilly. | Horizontal Tubular. | 1885 | 30½ | 1,130 | 115 | 110 | 70 | | | | Good. |
| | 2 Pennsylvania. | Scotch Marine. | 1899 | 36 | 1,380 | 140 | 160 | 130 | | | | Good. |
| High Bridge.... | 1 Delamater. | Horizontal Tubular. | 1876 | 49 | 1,430 | 140 | 60 | 60 | | | | Good. |
| | 1 Delamater. | Ditto. | 1881 | 42 | 1,430 | 140 | 60 | 60 | | | | Good. |
| Jerome Park..... | 3 I. P. Morris. | Scotch Marine. | 1903 | 39 | 1,400 | 140 | 160 | 155 | | | | New. |

coal vault; boiler house one story, 40 by 50 feet. Brick wall between has single unprotected opening. Both buildings located on side hill, are of ordinary brick and stone construction with slate and copper roof, on wooden sheathing and trusses; joisted wooden and cement floors.

*Hazards.*—No exposures. General condition of station, fair. Lighting by gas.

*Protection.*—None.

*Fuel.*—Coal supplied under annual contract; contractor under bond. Seven to eight days' supply of coal in boiler room; 25 days' supply on dock.

**Jerome Park Pumping Station.**—*General.*—Located east of Jerome Park reservoir on Jerome avenue, in The Bronx. Supplies High service in The Bronx. Pumps draw from suction tanks fed by 48-inch branch from Old Croton aqueduct. Ultimately will be supplied from Jerome Park reservoir.

*Equipment.*—Two 10,000,000 gallon engines, just erected and not yet accepted from makers, pump through equalizing standpipe into mains of Bronx High service.

*Operating Force.*—In three shifts; at least 4 men in each; extra men on day shift as needed.

*Construction.*—Station is of fireproof construction throughout with iron roof trusses and iron and slate covering, 53 by 392 feet, one story and basement. Floors of tile or cement and walls of stone or brick. Windows have metal frames. All doors in brick division walls of iron except that between coal room and boiler room, which is a temporary wooden door.

*Hazards.*—No exposures. Oils kept in special fireproof room leading off basement, containing a quantity of lubricating oils in barrels and in three 150-gallon iron tanks. Doors are iron and kept closed. Waste and other supplies kept in a wooden closet built in one corner of the main pump room well away from all machinery. Wooden coal trestle in coal room.

*Protection.*—Two hand reels in boiler room; each with play pipe and 150 feet of 2½-inch cotton rubber lined hose; no inside standpipes or hose connections. Two double hydrants at street curb alongside building draw from 48-inch main under about 73 pounds pressure. Six 3-gallon hand chemical extinguishers, distributed in pump room.

*Fuel.*—Coal supplied under annual contract; contractor under bond. Usually about 75 days' supply on hand.

**LOW SERVICE, MANHATTAN.—General.**—The Low service supplies by gravity flow from Central Park reservoirs, elevation 118, and from Croton aqueduct at One Hundred and Thirty-fifth street gate house, the territory south of Thirty-fourth street, most of that east of Lexington avenue and that part north of Ninety-seventh street east of Eighth avenue. This includes practically all of the high value and important districts of Manhattan as outlined on accompanying plan and described in detail under Conflagration Hazard, Sections 1 to 10, inclusive, also includes a large part of the residence district. Area supplied about 16.5 square miles, with an estimated population of 1,720,000.

A separate fire main system for the protection of more important districts will soon be under construction. This system, described later, will be supplied by two new independent pumping stations which will draw from the distribution system.

**Main Arteries.**—This service is supplied by six 48-inch mains and two 36-inch mains from the new receiving reservoir in Central Park, by two 30-inch mains and three 36-inch mains from the old receiving reservoir in Central Park, and by two 48-inch mains from One Hundred and Thirty-fifth street gate house; these main arteries supply secondary feeders of from 24 inches to 12 inches diameter, as shown on the accompanying plan. While fairly well supplied by large main arteries, the service is generally weak in secondary feeders, making large areas dependent on a gridiron of small mains with inadequate arterial support. This is particularly true of the Lower East Side, and the large area north of One Hundred and Tenth street east of Ninth avenue. An important area on the west side south of Twenty-third street is also very weak in seconday feeders, but will be adequately protected by the proposed separate fire main service.

**Minor Distributers.**—Financial, Chemical, Machinery and Grocery Sections (see under Conflagration Hazard), 6-inch mains poorly connected; a 12-inch gridiron is gradually being substituted. Lower part of the Wholesale Dry Goods and Manufacturing Section, 12-inch mains well gridironed; upper part, 6-inch frequently connected by secondary feeders. Retail Mercantile Section; exclusively 12-inch, well gridironed and frequently connected to secondary feeders. Tenement sections, particularly the Lower East Side; large areas dependent on 6-inch gridirons with but few secondary feeders. This is also true of the residence section above One Hundred and Twenty-fifth street, but in a less marked degree. Dead ends, except at service limits, insignificant.

**MAIN HIGH SERVICE, MANHATTAN.—General.**—This service supplies by direct pumpage from Ninety-eighth street and One Hundred and Seventy-ninth street pumping

stations, with High Bridge reservoir, elevation 219, as equalizer, the entire high-class residence section and part of the theatre and hotel section. Estimated population, 348,000. Area about 3.5 square miles, mainly closely built. Elevations range from 60 to 140, averaging about 100.

**Main Arteries.**—A 48-inch force main from the One Hundred and Seventy-ninth street pumping station supplies two 36-inch mains at One Hundred and Seventy-ninth street and Amsterdam avenue, one of which runs south through St. Nicholas avenue and Broadway to Fifty-ninth street, with cross-connections to secondary feeders at intermediate points. The other 36-inch main runs south through Amsterdam avenue, One Hundred and Forty-fifth street, Broadway and Eighty-sixth street, then east across Central Park, supplying the east side. A 36-inch force main from the Ninety-eighth street pumping station feeds a 20-inch main supplying the district east of Central Park and also a 20-inch main running south on Broadway to a small high class residence district south of Central Park. The entire Main High service is provided with a system of 20 and 12-inch secondary arteries, well connected at intersections.

**Minor Distributers.**—Almost entirely 6-inch mains, well gridironed, reinforced at frequent intervals by 12-inch. Dead ends, except at service limits, are few, occurring mainly in the western part.

**UPPER HIGH SERVICE, MANHATTAN.—General.**—This service supplies the territory from One Hundred and Eighty-ninth street north to Dykman street, and is almost entirely a residence section. Area about 1.5 square miles. Supplied by high pressure pumps at One Hundred and Seventy-ninth street pumping station, using High Bridge tower, elevation 324, as an equalizer. Elevations range from 160 to 225, average about 200. Population served estimated at 35,000. The gridiron system entirely covers the thickly settled portion of the service; thinly populated portions are supplied by unsupported distributing mains.

**Main Arteries.**—A 30-inch main from the pumping station reducing to 20 inch at One Hundred and Seventy-ninth street and Amsterdam avenue, continues west through the gridiron, connecting at every avenue.

**Minor Distributers.**—Six-inch, reinforced by 12 inch in thickly settled portions. Some 4 inch in thinly settled portion. Gridiron good. Insignificant number of dead ends, all in outlying district.

**LOW SERVICE, BRONX.—General.**—This supplies by gravity flow from the Old Croton aqueduct, elevation 124, the congested mercantile and manufacturing district east and north of the Harlem river; a small district in Manhattan north of Dykman street and the following large thinly settled areas: east of Southern boulevard and south of Pelham parkway, east of Hutchinson river, and City Island. These outlying areas were until recently supplied by the New York and Westchester Water Company. This recently acquired part of the service is almost entirely undeveloped, with small mains and few connections, but is being remodelled by the city.

Area supplied about 12.0 square miles, with an estimated population of 105,000. Elevations range from 10 to 60, average about 35.

**Main Arteries.**—This service is supplied from the Old Croton aqueduct at a point near the north end of the Jerome Park reservoir through two 48-inch mains, one going west and south connecting with a 36-inch, which supplies Manhattan above Dykman street, the other going east and south reducing to 36-inch at One Hundred and Seventy-third street, whence it continues along Southern boulevard, through the congested value district, to Willis avenue, connecting directly at several points to the gridiron system. Secondary feeders entirely lacking. The entire eastern section is supplied by one 20-inch main and one 12-inch main, poorly supported. Many improvements are proposed by the department.

**Minor Distributers.**—In the congested district, 12-inch and 6-inch mains gridironed but lacking proper connections at some points, leaving frequent dead ends. In the thinly built eastern district long lines of 4-inch, 6-inch and 8-inch mains, not gridironed. Additional minor distributers in the entire service are being installed.

**WILLIAMSBRIDGE SERVICE, BRONX.—General.**—This supplies by gravity flow from Williamsbridge reservoir, elevation 190, the greater occupied portion of The Bronx lying north of One Hundred and Fifty-sixth street and west of the Bronx River. Almost entirely a well built-up residence district, with an estimated population of 110,000, area about 7.2 square miles. Elevations range from 60 to 120, average 90.

**Main Arteries.**—Two 36-inch mains, one supplying the eastern portion and the other the western portion of the service. These two principal feeders supply an arterial system mainly of 12-inch loops and cross connections. The whole system is weak in necessary secondary arteries.

**Minor Distributers.**—Mainly 6 inch, poorly gridironed, with numerous dead ends.

**HIGH SERVICE, BRONX.—General.**—This supplies by direct pumpage from Jerome Park pumping station through a standpipe,

elevation 300, a thinly populated district in the southern part of The Bronx. Area served 6.5 square miles, with an estimated population of 56,000. Elevations range from 120 to 250, average about 145.

**Main Arteries.**—Two 36-inch mains from pumping station, one supplying the district north of Gun Hill road through two long and one short unsupported 20-inch distributers. The other runs south from One Hundred and Ninety-fourth street and supplies through a 20-inch main one long and several short unsupported 12-inch secondary arteries.

**Minor Distributers.**—Six-inch and 4-inch mains partially gridironed east of Bronx River, but with many dead ends.

**MAINTENANCE OF DISTRIBUTION SYSTEM.**—For purposes of inspection and maintenance the Boroughs of Manhattan and The Bronx are divided into seven districts, the boundaries of which will be found defined under "Hydrant Inspection." In each district there is a permanent repair company in addition to three "floating" gangs, so-called, each of which is under a foreman who reports to and receives instructions from the engineer of pipes and distribution. Foremen of district repair companies are responsible for the condition of the mains, gate valves, hydrants, covers, etc., in their respective districts, each company being equipped to handle breaks and make repairs on mains, hydrants and gate valves under 20 inches in diameter. Two of the "floating" gangs have charge of the repairs on mains and gate valves 20 inches and larger diameter, the other handles special work assigned. Foremen of repair companies make daily reports on printed forms showing nature of trouble and work done, time required to make repairs, material used, etc.

In general, headquarters of repair companies are well located. The headquarters of District No. 2, from Houston to Forty-second streets, is unfavorably situated in the northwest part of the district as the southern section of this district is of greater relative importance.

Until very recently the organization of the repair companies has been notoriously loose, and they have amply demonstrated in various cases an absolute incompetency satisfactorily to discharge, under the existing conditions of organization and control, the important duties delegated to them. On Sunday, July 11, 1905, a 48-inch main burst in Park avenue between Forty-first and Forty-second streets, doing a large amount of damage to property; the "shut-off" was not made until four hours after the break was reported. During the night of August 7, 1905, there was a break in a 6-inch main in Centre Market place which did considerable damage; "shut-off" was not made until six hours after notice of the break had been received at the district repair company's headquarters on Worth street, about seven blocks distant.

Since the dates of the above cited disastrous breaks, the repair companies have been reorganized. The force, consisting of a foreman, assistant foreman, hydrant inspectors and repair men, is now divided into three gangs working in three 8-hour shifts; in addition there are at all times two men on telephone duty. The companies are furnished with teams, and men on the night shifts are employed near headquarters, where they can be readily reached in an emergency. This organization is a move in the right direction and should give better results. However, the repair companies as now organized do not contain enough men of sufficient ability to locate and handle to good advantage breaks and other troubles, dependence for prompt action being placed almost entirely upon the personal knowledge of the foreman and a few men. The plans of the distribution system furnished the foremen do not show with sufficient accuracy the location of gate valves, mains and hydrants, but pending the completion of a survey of the distribution system recently instituted by the chief engineer, they are the best now available. The fire department has been instructed to co-operate with the water department by immediately reporting to repair companies all breaks which may come to its notice; the fire department has been provided with distribution maps similar to those furnished the repair companies. In general, there is not proper co-operation between the two departments.

Pipe yards are located at East Twenty-fourth street and at East One Hundred and Fortieth street; the One Hundred and Fortieth street yard is in course of development, having only recently been established. There are no well equipped repair shops maintained by the department, and it is not in a position to make its own repairs, other than those of a minor nature, which are made at the repair company's headquarters and at the Twenty-fourth street pipe yard. Repairs of magnitude are made at shops of private concerns at unnecessary expense and delay. The department is not adequately equipped with trucks adapted to handle to advantage large pipe and heavy repair outfits. In general, the emergency methods, the repair shops, trucks, etc., of the several corporations operating public service utilities in the city are in strong contrast to the methods and equipment employed by the water department.

**PIPES.—Length and Age.**—Table No. 10 shows length and age of various sizes of pipes

in service January 1, 1905, 4 inches and larger in diameter, as compiled from records of the water department.

TABLE No. 10.—PIPES IN SERVICE JANUARY 1, 1905.

| Diameter in Inches. | Length. | | Age. | |
|---|---|---|---|---|
| | Miles. | Per Cent. of Whole. | Per Cent. Less than 5 Years Old. | Per Cent. Less than 10 Years Old. |
| 4 | 12.07 | 1.24 | 8 | 9 |
| 6 | 559.41 | 57.64 | 9 | 17 |
| 8 | 0.36 | 0.03 | 100 | 100 |
| 10 | 1.25 | 0.13 | 00 | 00 |
| 12 | 238.87 | 24.62 | 17 | 27 |
| 16 | 4.02 | 0.42 | 19 | 19 |
| 20 | 60.67 | 6.25 | 24 | 37 |
| 24 | 2.19 | 0.22 | 00 | 00 |
| 30 | 8.24 | 0.85 | 00 | 1 |
| 36 | 50.23 | 5.18 | 12 | 48 |
| 48 | 33.14 | 3 42 | 20 | 40 |
| Total. | 970.45 | 100.00 | 12.6 | 23.0 |

Pipes are of both cast and wrought iron; in addition to those tabulated there are east of the Bronx River about 50 miles of pipe from 4 inches to 20 inches in diameter, purchased from the New York and Westchester Water Company in 1903. The opinion of Consulting Engineer Birdsall is that approximately 100 miles of pipe still in service was laid prior to 1850, and that 200 miles of pipe now in use is over 30 years old.

**Condition and Cover.**—Previous to 1859, no tar-coated pipe was laid, but for the last 20 years at least nothing but tar-coated, vertically cast pipe has been used on new contracts. Only a small amount of pipe was on hand at the pipe yard for examination. The older mains show tuberculation; a piece of pipe cut from a 12-inch main at the corner of Seventy-second street and Broadway, probably 20 years old, showed incrustation with tubercles projecting about one-half inch from the inner surface. Mains are flushed by discharging through blow-offs, or from one hydrant at a time, only when complaints are received of unsatisfactory condition of water; tests made by National Board engineers indicate little sediment deposit in the mains.

Mains are laid with a cover of 4 feet. The frost penetration seldom exceeds 3½ feet. Mains at railroad and river crossings are either well buried or are boxed, and no trouble has been experienced from frozen mains.

**Specifications.**—Specifications for cast-iron pipe recently adopted are well drawn, containing the usual clauses relating to inspections and tests. They require an inspection at the foundry as well as a test of the mains after installation.

**Electrolysis.**—No extended electrical surveys have been made by the water department, but Mr. G. F. Sever, consulting engineer of the department, has made a few tests in Manhattan and The Bronx. The results of the tests have not been collated, but Mr. Sever states that no reading taken showed pipe positive to ground, or rail, by large amounts. The Interborough Rapid Transit Company has made systematic tests throughout the entire city, but results are not obtainable.

Known damage to water pipes through electrolytic action is confined entirely to services, most of them in The Bronx. Where electrolysis has been observed, in the northern districts where overhead electric trolleys are in use, the corrosion has started at the junction of the dissimilar metals at the corporation cock of the service connection. The comparative exemption from electrolysis of water pipes in Manhattan may be explained by the good provision of return circuits on the underground trolley and elevated railroad systems.

**GATE VALVES.—Number and Type.**—The total number of valves of 4 inches and larger diameter in the distribution system in January, 1905, was 11,591. Valves are almost exclusively of an antiquated department design. A few of the 20-inch and many of the 12-inch valves are of the solid-body type; others bolted-body. In general, gate valves close by turning to the right, but a few are geared to turn to the left. Specifications recently adopted by the department call for a gate valve of modern design in accordance with good practice.

**Spacing.**—Below Forty-second street the valve distribution is on the whole fairly uniform, and such that the average length of pipe which would be affected by a single break in the mains is about 900 feet, although there are some extreme cases where a single break would cut out of service from 2,000 to 3,000 feet of mains. Above Forty-second street, valves are not as closely spaced on mains. In a representative section of the upper East Side tenement district from Fifty-ninth to Seventy-second street, the valve distribution is such that on the average 1,500 feet of mains would be cut out of service by a single break with a maximum of 3,200 feet; similar figures for the high class West Side residence section between Seventy-second and Eighty-first streets are 1,400 and 3,100 feet.

**Inspection.**—Gate valves on mains of larger diameter are inspected annually by one of the "floating" gangs and are supposed to be then put in good condition. Smaller gates are not regularly inspected, maintenance being en-

tirely in the hands of the repair companies, and these valves are in general in very poor condition. The poor condition of valves, especially the small ones, is particularly pronounced in the lower portions of Manhattan, the poor design of all and the great age of many being contributory causes. Within the past year a competent inspector with four assistants was detailed to make a complete inspection of all valves of 20 inches and larger diameter and put them in good working order. This work, which is still in progress, is being done thoroughly. The vaults containing the large gates are also inspected and repaired; some are found dangerously full of illuminating gas.

A detailed inspection of 173 gates in Manhattan in groups at scattered locations, principally in the section below Forty-second street, was made by National Board engineers in September, 1905. Inspection extended from 48-inch to 6-inch valves. Many valves tested were found in poor condition, and two absolutely unworkable; one 12-inch gate on west side of Bowery south of Doyer street was closed with thread of valve stem stripped, unknown to the department; a 16-inch gate on Broadway at Stone street had head of valve stem broken, known to the department. Above Forty-second street, of 31 gates of all sizes inspected, 6, or 19 per cent., were in poor condition. Below Forty-second street, of 144 gates inspected, 45, or 31 per cent., were in poor condition. One 36-inch gate at Thirteenth street and Broadway was located with extreme difficulty, owing to the use of the Metropolitan Street Railway box cover instead of the department box cover, and trouble was experienced in locating two other gates for the same reason. Many asphalt covers are used which are hard to find when covered with snow and are then usually difficult to raise. Many gate vaults are full of water and mud, which freezes in winter and interferes with the closing of valves, and contractors frequently pile building material on the valve boxes, which is a cause of great delay in getting at gates.

**Closing of Valves.**—When gates are opened or closed the foreman in charge of the district is instructed to fill out a printed form to be filed at the main office; the entries are supposed to be transferred to a card index, but for over a year this has not been posted. Except in case of gate valves on the larger mains, no precautions are taken to ensure opening of valves closed to make repairs.

When supply to street mains is shut off by closing of valves, the captain of the nearest fire company is notified either by messenger or by telephone; he in turn notifies the battalion chief who sends notices to the surrounding fire houses within a radius of about two miles. Notification is sent in the same manner when supply to mains is restored by opening of valve. No confirming notice in writing is given by the water department.

**HYDRANTS.—Types.**—There were 15,482 hydrants in service October 1, 1905. Table No. 11, compiled from records of the department, gives classification, detailed dimensions and number of each make, January 1, 1905:

TABLE NO. 11.—HYDRANT DATA.

| Type. | Dimensions in Inches. | | Number and Diameter of Outlets. | | | Number of Each Type. |
|---|---|---|---|---|---|---|
| | Connection to Main. | Inside Diameter of Barrel. | 1–2½" | 1–2½" 1–4½" | 1–2½" 2–4½" | |
| No. 1, No. 2 and No. 3 Hydrants | 4 | 3 | 3,415 | ..... | ..... | 3,415 |
| "A" Hydrant | 6 | 3½ | 4,422 | 518 | ..... | 4,940 |
| "B" Hydrant | 6 | 5 | ..... | 1,702 | ..... | 1,702 |
| New York Case | 6 | 4 | 586 | 2,678 | ..... | 3,264 |
| Victor | 6 | 5 | ..... | 131 | ..... | 131 |
| Standard Double Nozzle New York | 6 | 7½–8½ | ..... | 29 | ..... | 29 |
| Standard Triple Nozzle New York | 8 | 9½–10½ | ..... | ..... | 173 | 173 |
| Miscellaneous | (Principally in The Bronx.) | | | | | 343 |
| Total | .... | ..... | 8,423 | 5,058 | 173 | 13,997 |

All hydrants are of the post type and, with the exception of a few in The Bronx, are of the department design. The Standards are known locally as Smith hydrants. The New York case, Victor and Standard hydrants are made with frost-jackets; all others are set in conical wooden boxes. Only the Standard three-outlet hydrant has independent gate valve on outlets. Foot-valves of all hydrants except the Standard are operated by a permanent "T" handle; the Standard by portable wrench on head of valve stem.

All hydrants on mains of 20 inches or greater diameter have gate in connection with street main, and a few of those on 12-inch mains are similarly provided. Quite recently the rule has been adopted of putting gate valves in all hydrant connections for mains 12 inches or more in diameter. All hydrants have compression valves opening against the pressure. Hydrants, except the Standard, of which there are only a comparatively insignificant number in service, are of an antiquated type and are in general in poor condition; this is particularly

true in the lower portion of Manhattan. Barrel diameters are small, 83 per cent. being 4 inches or less, and only 40 per cent. of hydrants in service have more than one 2½-inch outlet, and but a trifling number have more than one 2½-inch outlet and one 4½-inch outlet. It is stated to be the policy of the department to replace the old type of hydrant by the new "Standard," but this is not progressing with anything like the rapidity demanded by the gravity of the situation.

**How Located.**—The location of new hydrants is determined by the water department, but additional hydrants are frequently recommended by the fire department and when so recommended are placed.

**Drainage.**—Hydrants are equipped with automatic drip-valves and the New York case and Standard hydrants have connection to sewer. The older types drain into pockets of stone and the drainage in these cases is extremely poor, to which cause may be properly attributed many of the frozen hydrants.

**Freezing.**—Serious difficulty is experienced from frozen hydrants. In winter, additional inspections are made by the water department, but they do not appear to be conducted with sufficient thoroughness. In severe weather some of the fire companies devote nearly their entire time to thawing out hydrants; steamers carry special hose for the purpose. Salt is also used for thawing. The chief of the fire department states that in 1904 his department thawed out 1,651 hydrants, and in 1905 about 1,800. The most pronounced contributory cause of freezing appears to be the use of hydrants by the street department and by unauthorized persons.

**Inspection.**—Both the water and fire departments make inspections of hydrants. In each of the four lower repair company districts of Manhattan there are from two to four hydrant inspectors who are supposed to cover the territory every few weeks. The rules for inspection call for removing cap, operating foot valve, noting the condition of stuffing box, outlet, etc. The inspector reports to the district foreman all cases needing repair. In the upper repair company districts no systematic inspections are made by the water department, but the commanding officer of each fire company has monthly inspections of all hydrants in his territory; reports of these inspections are filed at headquarters and the water department is immediately notified of all hydrants discovered out of repair. It is claimed by the fire department that its reports to the water department do not receive proper attention. After fires no inspection is made by the water department, but fire department engineers are supposed to leave hydrants in good order, or notify water department of any necessary repairs.

More than 1,000 hydrants well distributed over the respective repair company districts were inspected by National Board engineers in June and July, 1905, and in general their condition was found to be unsatisfactory. Many were hard to operate, leaky, badly worn, and otherwise out of order. The summary below shows in detail the result of the inspection.

*Repair Company District No. 1.—Battery to Houston Street.*

| | |
|---|---|
| Total number of hydrants inspected | 165 |
| Total number of hydrants found in good condition | 68, or 41 per cent. |
| Total number of hydrants found unserviceable | 11, or 7 " |
| Total number of hydrants needing packing, calking or other repairs | 86, or 52 " |

Few hydrants are far enough away from curb to protect them from injury by traffic; an insignificant number are protected by guards. Two hydrant inspectors, a repair man and team are detailed on hydrant inspections.

*Repair Company District No. 2.—Houston to Forty-second Street.*

| | |
|---|---|
| Total number of hydrants inspected | 187 |
| Total number of hydrants found in good condition | 88, or 47 per cent. |
| Total number of hydrants found unserviceable | 20, or 11 " |
| Total number of hydrants needing packing, calking or other repairs | 79, or 42 " |

Headquarters of this district are in the northwest portion of the territory. Misuse and abuse of hydrants greater in the southern part and along river fronts than elsewhere.

*Repair Company District No. 3.—Forty-second to Ninety-sixth Street.*

| | |
|---|---|
| Total number of hydrants inspected | 163 |
| Total number of hydrants found in good condition | 90, or 55 per cent. |
| Total number of hydrants found unserviceable | 8, or 5 " |
| Total number of hydrants needing packing, calking or other repairs | 65, or 40 " |

This district is divided into four divisions, one hydrant man detailed to each division. The condition of hydrants west of Fifth avenue is decidedly better than those east of this thoroughfare, due to difference in character of population of the two sections, to the superior type of hydrants in the west section and the better character of work of men detailed to that section.

*Repair Company District No. 4.—Ninety-sixth to One Hundred and Seventy-third Street.*

| | |
|---|---|
| Total number of hydrants inspected | 140 |
| Total number of hydrants found in good condition | 129, or 92 per cent. |
| Total number of hydrants found unserviceable | 1, or 1 " |
| Total number of hydrants needing packing, calking or other repairs | 10, or 7 " |

Two men with team are detailed on hydrant inspection. In general, hydrants are in good condition.

*Repair District No. 5.—Bronx, Harlem River to Tremont and Burnside Avenues.*

| | |
|---|---|
| Total number of hydrants inspected | 247 |
| Total number of hydrants found in good condition | 169, or 68 per cent. |
| Total number of hydrants found unserviceable | 10, or 4 " |
| Total number of hydrants needing packing, calking or other repairs | 68, or 28 " |

Some hydrants in sparsely settled localities do not appear to have been opened in years. One man only on hydrant work in this district and his entire time is devoted to making repairs. Police, sprinkling-cart men, and private citizens report hydrants that are out of order. In the more important sections of this district hydrants were found to be in good condition.

*Repair Company District No. 6.—Bronx, Tremont and Burnside Avenues North to City Line and One Hundred and Seventy-third Street to Spuyten Duyvil on Manhattan Island.*

| | |
|---|---|
| Total number of hydrants inspected | 168 |
| Total number of hydrants found in good condition | 87, or 52 per cent. |
| Total number of hydrants found unserviceable | 9, or 5 " |
| Total number of hydrants needing packing, calking or other repairs | 72, or 43 " |

Considering the great area of this district and the small force assigned to same, the condition of hydrants is good; those in need of repair are reported as in District No. 5.

*Repair Company District No. 7.—East of Bronx River.*

No hydrants in this district inspected by National Board engineers. No man detailed for hydrant inspection or repairs and no regular inspection attempted.

**Use by Street and Other Departments.**—Street and sewer departments use hydrants for flushing and cleaning purposes and such use is one of the several contributory causes for their bad condition. City departments other than the fire department have been requested by the water department to confine their use when possible to the old single outlet type, but to little effect.

**Use by Unauthorized Persons.**—Hydrants, in the down-town district especially, are of an antiquated type, many out of repair, so that the covers of most of them can be readily lifted, permitting their ready operation by means of the affixed "T" handle; this results in their being largely used by unauthorized persons without the knowledge of the department. Children and malicious persons lift the covers and fill the tops with broken glass, sand and other material. The police are not sufficiently vigilant in preventing this mischief and the unauthorized use of hydrants.

**Distribution.**—In the districts below Twenty-third street, excepting the upper east side tenement district, No. 13, Plan 1, the average area served by each hydrant ranges from 19,060 square feet to 36,800, with a general average of 25,500 square feet.

In the districts above Twenty-third street the theatre and hotel district, No. 10, Plan 1, contains one hydrant for every 32,700 square feet, with an average linear spacing of 131 feet. In the other districts, including The Bronx, the average area per hydrant varies from 47,700 square feet to 65,200 square feet.

**Tests.**—*Hydrants Selected for Test.*—Tests of 321 hydrants in well scattered groups were made by National Board engineers in July and August, 1905. Fewer tests were made in the important wholesale dry-goods district than would otherwise have been the case on account of the proposed installation in the near future of the high pressure separate fire main system for the protection of this district and adjacent territory. Groups were arranged to embrace those hydrants which would naturally be used in case of fire in the locality in question. In selecting hydrants for tests, consideration was given to the importance of the occupancy and to the size and arrangement of mains. Some of the groups were selected with the intention of developing a suspected weakness in the distributing pipe system; others in following out the consideration just cited were selected at the stronger places on the mains. Thus, the tests embrace hydrants on mains of all sizes, from 36 inches down to 6 inches in diameter. The different types of hydrants in use were recognized by being included in the tests in about the same proportion that they bear to the whole installation. Hence, the combined tests are fairly representative of average conditions regarding the fire engine supply available from hydrants. Results of tests are classified in Table No. 12 and locations of groups are shown on accompanying plans.

## TABLE No. 12.—HYDRANT TESTS.

| Sections. | Number and Location of Group*. | Number of Hydrants in Group. | Outlets Discharging. 2½" | Outlets Discharging. 4½" | Diameter of Mains, Inches. | Discharge, Gallons per Minute. Individual Hydrants. | Total of Group. | Average per Hydrant. | Average Pressure with Hydrant Outlets Closed, Pounds per Sq. In. |
|---|---|---|---|---|---|---|---|---|---|
| Section 1.... | 1 Broadway and Park Row. | 5 | 5 | 1 | 24 | 460, 530, 530, 620, 890 | 3,030 | 610 | 17 |
| Section 2.. | 2 Broad and Front Sts. | 4 | 4 | 1 | 12 | 470, 600, 620, 2240 | 3,930 | 980 | 27½ |
| | 3 Maiden Lane and Front St. | 6 | 6 | 1 | 12 | 520, 530. 530, 560, 630, 630 | 3,400 | 570 | 26½ |
| Section 3.. | 4 Rector and Washington Sts. | 6 | 6 | 0 | 12 | 430, 530, 560, 590, 630, 640 | 3,380 | 560 | 27½ |
| | 5 Barclay and West Sts. | 6 | 6 | 0 | 12 and 6 | 510, 520, 560, 590, 610, 650 | 3,440 | 570 | 28½ |
| Section 4.... | 6 Roosevelt and Batavia Sts. | 6 | 6 | 1 | 12 and 6 | 410, 430, 560, 650, 660, 1580 | 4,290 | 710 | 25½ |
| Section 5.. | 7 Vestry and Washington Sts. | 6 | 6 | 0 | 12 and 6 | 400, 480, 580, 590, 590, 620 | 3,260 | 540 | 29½ |
| | 8 McDougal and Spring Sts. | 6 | 6 | 0 | 6 | 310, 370, 430, 430, 440, 490 | 2,470 | 410 | 21½ |
| Section 6.. | 9 Broadway and Howard Sts. | 6 | 6 | 3 | 30, 12, 6 | 530, 570, 570, 1580, 2130, 2410 | 7,790 | 1,300 | 26 |
| | 10 Prince and Mercer Sts. | 6 | 6 | 1 | 12 and 6 | 390, 400, 430, 510, 530, 1330 | 3,590 | 600 | 21 |
| | 11 Baxter and Canal Sts. | 5 | 4 | 1 | 6 and 12 | 380, 410, 520, 530, 850, | 2,690 | 540 | 22 |
| | 12 Pike and Madison Sts. | 6 | 6 | 1 | 12 and 6 | 50, 190, 320, 380, 480, 900 | 2,320 | 390 | 19 |
| Section 7... | 13 Allen and Grand Sts. | 6 | 6 | 0 | 6 and 12 | 10, 30, 150, 390, 480, 490 | 1,550 | 260 | 15 |
| | 14 Madison and Clinton Sts. | 6 | 6 | 0 | 12 and 6 | 380, 380, 390, 470, 490, 540 | 2,650 | 440 | 20½ |
| | 15 Broome and Attorney Sts. | 6 | 6 | 0 | 12 and 6 | 240, 260, 310, 340, 390, 410 | 1,950 | 320 | 18½ |
| Section 8..... | 16 Bethune and Washington Sts. | 6 | 6 | 2 | 12 and 6 | 170, 240, 310, 490, 770, 1330 | 3,310 | 550 | 31 |
| Section 9... | 17 23d St., between 5th and 6th Aves. | 6 | 6 | 2 | 12 and 6 | 560, 560, 580, 720, 1580, 2240 | 6,240 | 1,040 | 23 |
| | 18 34th St., between 6th and 7th Aves. | 5 | 5 | 3 | 12 | 580, 700, 930, 1300, 1330, | 4,840 | 970 | 29 |
| | 19 10th Ave. and 28th St. | 6 | 6 | 4 | 12, 20, 36 | 560, 650, 930, 1250, 1790, 2080 | 7,260 | 1,210 | 35 |
| | 20 11th Ave. and 34th St. | 6 | 6 | 1 | 6 and 12 | 240, 260, 260, 290, 290, 1430 | 2,770 | 460 | 35 |
| | 21 9th Ave. and 39th St, | 6 | 6 | 0 | 6 | 400, 460, 510, 510, 530, 590 | 3,000 | 500 | 26 |
| Section 11.. | 22 8th Ave. and 46th St. | 6 | 6 | 1 | 6 and 12 | 410, 420, 420, 490, 490, 940 | 3,170 | 530 | 23 |
| | 23 56th St., between 11th and 12th Aves. | 3 | 3 | 0 | 6 | 580, 610, 640, | 1,830 | 610 | 35 |
| | 24 8th Ave., 56th to 58th Sts. | 5 | 5 | 1 | 12 and 30 | 320, 440, 530, 630, 910 | 2,830 | 570 | 12 |
| | 25 Columbus Ave., 61st and 62nd Sts. | 6 | 6 | 0 | 6 | 360, 420, 460, 490, 580, 620 | 2,930 | 490 | 11 |
| Section 12A | 26 Lexington Ave. and 24th St. | 3 | 3 | 0 | 6 | 370, 490, 780, | 1,640 | 550 | 23 |
| | 27 46th St., 6th to 7th Aves. | 5 | 5 | 3 | 12 and 6 | 430, 540, 1400, 1430, 1510 | 5,310 | 1,060 | 19 |
| Section 12B | 28 Amsterdam Ave., 88th to 90th Sts. | 6 | 6 | 0 | 6 | 510, 510, 510, 530, 590, 670 | 3,320 | 560 | 29½ |
| | 29 101st St., Amsterdam Ave. to Columbus Ave. | 6 | 6 | 1 | 6 and 12 | 410, 460, 530, 690, 790, 1440 | 4,320 | 720 | 35 |
| | 30 Houston St. and 1st Ave. | 6 | 6 | 5 | 20 and 36 | 400, 580, 1020, 1440, 1590, 1690 | 6,720 | 1,120 | 19½ |
| | 31 Ave. C and 10th St. | 6 | 6 | 1 | 6 | 260, 310, 320, 340, 350, 450 | 2,030 | 340 | 26 |
| Section 13.. | 32 1st Ave. and 33d St. | 5 | 5 | 1 | 6 | 180, 200, 240, 310, 1790, | 2,720 | 540 | 36½ |
| | 33 3d Ave and 60th St. | 6 | 6 | 0 | 12 and 6 | 260, 340, 490, 510, 510, 530 | 2,640 | 440 | 19 |
| | 34 Ave. A and 59th St. | 6 | 6 | 0 | 6 | 320, 320, 370, 400, 470, 480 | 2,360 | 390 | 22½ |
| | 35 2d Ave. and 85th St. | 6 | 6 | 1 | 48, 12, 6 | 380, 380, 430, 450, 460, 1820 | 3,920 | 650 | 15 |
| | 36 101st St., between Lexington Ave. and Exterior St. | 6 | 6 | 1 | 6 | 580, 600, 610, 690, 690, 700 | 3,870 | 650 | 30 |
| | 37 8th Ave., 116th to 118th Sts. | 6 | 6 | 1 | 6 and 12 | 510, 540, 630, 650, 690, 1440 | 4,460 | 740 | 32 |
| | 38 1st Ave. and 113th St. | 6 | 6 | 0 | 6 | 490, 530, 550, 550, 600, 600 | 3,320 | 550 | 35 |
| Section 14.. | 39 Pleasant Ave. and 119th St. | 6 | 6 | 0 | 6 | 50, 50, 170, 390, 410, 450 | 1,520 | 250 | 33 |
| | 40 3d Ave. and 123d St. | 6 | 6 | 0 | 6 and 12 | 240, 410, 440, 630, 810, 900 | 3,430 | 570 | 34 |
| | 41 125th St., between Lenox and 7th Aves. | 6 | 6 | 1 | 48, 6, 20 | 50, 380, 570, 670, 740, 2410 | 4,820 | 800 | 39 |
| | 42 5th Ave., between 126th and 130th Sts. | 6 | 6 | 0 | 6 | 50, 240, 240, 450, 530, 600 | 2,110 | 350 | 35 |
| | 43 8th Ave., between 133d and 136th Sts. | 6 | 6 | 0 | 12 and 6 | 240, 450. 510, 520, 560, 580 | 2,860 | 480 | 30 |
| | 44 Southern Boulevard, Alexander to Lincoln Ave. | 6 | 6 | 1 | 12, 20, 6 | 610, 660, 700, 870, 870, 1300 | 5,010 | 720 | 39 |
| | 45 Gerard Ave. and E. 138th St. | 6 | 6 | 3 | 12 | 380, 380, 430, 600, 720, 960 | 3,470 | 590 | 35 |
| | 46 Willis Ave. and E. 139th St. | 6 | 6 | 1 | 6 and 12 | 530, 570, 570, 610, 630, 930 | 3,840 | 640 | 29½ |
| | 47 Brook Ave. and E. 139th St. | 5 | 5 | 2 | 6 | 430, 450, 470, 910, 1400 | 3,660 | 730 | 34½ |
| | 48 Southern Boulevard and E. 138th St. | 4 | 4 | 0 | 12 and 36 | 610, 650, 720, 720 | 2,700 | 680 | 30½ |
| | 49 Locust Ave. and E. 138th St. | 5 | 5 | 0 | 6 and 12 | 450, 470, 540, 560, 610 | 2,630 | 530 | 40½ |
| Section 15.. | 50 3d Ave. and E. 149th St. | 4 | 4 | 1 | 12 and 6 | 380, 540, 630, 1860 | 3,410 | 850 | 31 |
| | 51 Gerard Ave. and E. 144th St. | 6 | 6 | 1 | 12 and 6 | 370, 440, 460, 460, 490, 1240 | 3,460 | 590 | 32½ |
| | 52 3d Ave. and E. 161st St. | 6 | 6 | 0 | 12 and 6 | 510, 530, 540, 560, 700, 890 | 3,730 | 620 | 29½ |
| | 53 Jackson Ave. and E. 161st St. | 6 | 6 | 0 | 6 | 240, 290, 430, 430, 460, 480 | 2,330 | 390 | 37 |
| | 54 Boston Road and E 169th St. | 6 | 6 | 0 | 6 | 380, 380, 410, 490, 490, 530 | 2,680 | 450 | 29½ |
| | 55 3d Ave. and E. 171st St. | 5 | 5 | 2 | 6 and 20 | 260, 430, 450, 1520, 1780 | 4,440 | 890 | 43 |
| | 56 3d Ave. and E. 177th St. | 6 | 6 | 0 | 12 and 20 | 690, 760, 790, 830, 850, 890 | 4,810 | 800 | 47 |
| | 57 Boston Road and E. 177th St. | 6 | 6 | 1 | 12 and 6 | 160, 620, 630, 700, 720, 1030 | 3,860 | 640 | 39 |

* Locations of groups are shown on accompanying plans by corresponding number. For description of sections see under Conflagration Hazard.

*Method of Testing.*—Hydrants were tested by means of a specially designed apparatus which measures directly the velocity of the jet issuing from the outlet. It was the purpose to make in all groups a measurement of the simultaneous free discharge from six adjacent hydrants, but this was not done in every instance for the following reasons: In some cases the distribution of the hydrants prevented the inclusion of as many as six in a natural group; in others one or more of the hydrants in a chosen group were found so badly out of order that they could not be operated and the distribution did not permit the addition of others to form a natural group; in a very few cases some hydrants in a selected group were omitted from the test on account of the condition of the streets. In some of the groups containing hydrants with 4½-inch outlets, it was found that the discharge from some or all of such outlets, with all outlets in the group open, was too feeble to be measurable with the testing apparatus. In these cases, the ultimate discharging capacity of the group is not limited by the number and size of available hydrant outlets, but by the capacity of the mains to deliver water at the point in question, and in measurement of the quantity at test some of the large outlets of such groups were closed. This procedure resulted merely in a different distribution between outlets of a given quantity of water. That this is so is shown in two typical tests, as follows: A group of six hydrants discharging from all outlets gave 7,240 gallons per minute; the same group after closing a 4½-inch outlet, thus reducing the total area of open outlets 17 per cent., gave a total discharge only .8 of 1 per cent. less than before. Again, a group of four hydrants discharging from all outlets gave 3,910 gallons per minute; this group after shutting off a single 2½-inch outlet hydrant, thus reducing the total area of open outlets 10 per cent., discharged a total quantity less than 3 per cent. smaller.

The conditions of the tests were much less severe than those which would obtain in fighting a moderately bad fire; during the year 1903 there were 58 fires of such magnitude as to require the services of an average of 12 engines each.

*Analysis of Tests.*—In Manhattan, under the conditions of the tests, only 30 per cent. of the hydrants tested gave a free discharge of as much as 600 gallons per minute, a fairly satisfactory supply for a second-size fire engine. However, some of the groups contained hydrants which yielded freely amounts much in excess of a good supply for a second-size engine, and, in some cases, if no more than a good supply for such an engine were taken from any hydrant in a group more water would be made available at some of the hydrants which gave low discharges. Accordingly, a careful detailed study of each group tested has been made with reference to the type of hydrant, arrangement and size of the distributing mains, relative locations of hydrants on the mains and other factors influencing discharge, to determine which of the hydrants giving low yield at the test would furnish a satisfactory supply for a second-size engine when no more than this amount is taken from any one of six adjacent hydrants in a group discharging simultaneously. This analysis of the tests shows conclusively that not more than 42 per cent. of the hydrants tested can be depended upon to furnish a fair to good supply for a second-size engine and probably somewhat less than this proportion, as the classification is made on a distinctly conservative basis in every respect.

In The Bronx 48 per cent. of the hydrants tested gave a free discharge of 600 gallons, or more, per minute, and an analysis of the tests, similar to that applied to those in Manhattan, shows that not over 58 per cent. of those in The Bronx can be depended upon to furnish a satisfactory supply for a second-size engine with six such engines drawing from adjacent hydrants simultaneously. Although themselves far from satisfactory, hydrants in The Bronx, in general, gave a larger discharge than those in Manhattan, a result which is to be attributed almost entirely to the influence upon the flow of the higher pressure in The Bronx.

Of the 321 hydrants tested, only 40, or 12 per cent., under the conditions obtaining, will furnish a full supply for a first-size engine. Those capable of furnishing such a supply are in all cases of the better types, with 4½-inch outlets, supplied from mains of 12 inches or larger diameter.

*Especially Noteworthy Groups.*—Attention is called particularly to a few noteworthy typical groups, as follows:

Group 17, at large department store, in Section 9, retail mercantile; 6 hydrants tested, 2 unsatisfactory.

Group 18, at large department store, in Section 9, retail mercantile; 5 hydrants tested, all satisfactory.

Group 41, at large department store, in Section 14, Harlem; 6 hydrants tested, 3 unsatisfactory.

Group 40, at large furniture store, in Section 14, Harlem; 6 hydrants tested, 3 unsatisfactory.

Group 49, at large machine shops and gas works, in Section 15, The Bronx; 5 hydrants tested, 4 unsatisfactory.

*Inadequacy of Single-outlet Hydrants.*—Of the hydrants with single 2½-inch outlets tested in Manhattan, only 37 per cent. will furnish a fair to good supply for a second-size engine,

while in The Bronx, owing to the higher pressures and somewhat better type of hydrant, 46 per cent. of those with a single 2½-inch outlet will furnish such supply. Some tests were made to determine the loss of pressure through friction in the single 2½-inch outlet hydrants with 4-inch barrel and 6-inch connection to main. These tests show that the friction loss in the hydrant barrel and the branch connection to main averages about 15 pounds for 600 gallons per minute discharge and nearly 20 pounds for discharge of 700 gallons. More than 90 per cent. of the single outlet hydrants have barrel smaller than 4 inches and a large proportion only a 4-inch connection to main. The low static pressures prevailing in this city and the large friction loss even in the best type of the single outlet hydrants adequately account for the poor showing made by these hydrants.

*Hydrants on Small Mains.*—A careful study of the tests shows clearly that hydrants of all types connected to 6-inch mains generally fail to give satisfactory yields save in a very few cases of those on especially well gridironed systems of such small mains close to the large feeders.

*Effect of Drafting from Large Number of Hydrants Simultaneously.*—Finally, it is to be remembered that during the tests only six hydrants at most were discharging at the same time, whereas the detailed study of the distribution system indicates that, in general, an attempt to draft simultaneously from more hydrants in the same locality, in combating severe fire conditions, would result in a reduced supply from individual ones and make the yield of most of them distinctly unsatisfactory.

**WORKS PROPOSED BY BOARD OF WATER SUPPLY.**—The imperative necessity of augmenting as soon as possible the supply to Manhattan from the Croton system, as well as the supply to other portions of the city, has been generally recognized for a number of years. In a report recently made by the Board of Water Supply to the Board of Estimate and Apportionment, the Catskill mountain sources are recognized as the most quickly available, and both the best and cheapest obtainable under the present conditions. The chief engineer recommends the development of the Esopus watershed by the construction of the Ashokan reservoir with storage of about 10 billion gallons, estimated to furnish a supply of 250 million gallons daily; to be followed as the growth of the city demands by the development in order of the Rondout, Schoharie, Catskill and other small watersheds with a total estimated yield of 660 million gallons per day. Also the immediate construction of a 500 million gallon aqueduct, 82 miles long, from the Ashokan reservoir to the Hill View distributing reservoir near Yonkers; this reservoir to have a capacity of 600 million gallons, flow line at elevation 295, with provision for future extension; and of a great equalizing reservoir near the present Kensico reservoir, to contain 25,000 million gallons.

It is estimated that with the most rapid progress, from five to eight years must elapse before water from this service is available, and then only by pushing first to completion the construction of that portion of the aqueduct 54 miles in length to the edge of the Croton watershed and conveying the water to the city through existing aqueducts, the capacity of which is considerably in excess of the safe yield from the Croton watershed in a dry year.

**PROPOSED HIGH PRESSURE SEPARATE FIRE MAIN SYSTEM.—General.**—The division of the Department of Water Supply, Gas and Electricity, having the design and installation of this system in charge, is well organized under competent engineers.

Contract for hydrants has been let and bids have been received for the pumping machinery of each station. Plans for the structures of the pumping station are about complete. Bids have been requested for the distribution system.

**Outline of System.**—The system is shown in red on Plan No. 1 and covers the district lying between Chambers street and Twenty-third street and extending from the Hudson River to the Bowery and Broadway, excepting a section equivalent to about 10 blocks at the northerly end.

Two pumping stations supplied from the present Croton system and provided with emergency salt water connections pumping through a well gridironed distribution system of mains from 24 to 12 inches in diameter will supply water to 1,266 hydrants.

The system will be built to stand a pressure of 300 pounds at the pumps.

**Source of Supply.**—A 60-inch main from the Central Park reservoir, connected at various points to the Manhattan Low service and reducing to 36 inch, will supply the pumps in the Gansevoort street station.

The Oliver street station will be supplied from existing Manhattan Low service mains. An emergency salt water suction will also be provided at each station.

**Pumping Stations.**—*General.*—Two pumping stations are to be built, one at the corner of South and Oliver streets near the East River, and the other at the corner of West and Gansevoort streets, near the Hudson River.

*Equipment.*—The equipment in each station is to be the same and will consist of 5 pumps of the multi-stage centrifugal type of 3,000 gallons per minute capacity direct connected to three-phase induction motors operated at 6,300-6,600 volts without the use of transformers. Automatic vacuum pumps are to be provided for the salt water emergency suction connections. Investigation of the several generating stations, sub-stations and storage batteries indicates ample capacity and a sufficient number of independent sources of supply. The total capacity of each station will be 15,000 gallons per minute against a pressure of 300 pounds. Foundations for a total of eight pumps in each station will be provided.

*Construction.*—The plans for the pumping stations indicate that they will be of satisfactory fireproof construction with exposed openings protected by wire glass. Those more seriously exposed will have in addition interior fire shutters.

*Hazards.*—Not serious except under the most adverse circumstances.

**Distribution System.**—The distribution will be through a well gridironed sytem of pipes from 24 to 12 inches in diameter, amply provided with gate valves suitably located. Calculations show that with both pumping stations in operation twenty 2-inch streams, or the equivalent thereof, could be delivered by the system around any desired block in the territory to be covered, with a friction loss between pumps and hydrants not exceeding 44 pounds. Provision in the system has been made for 8 available fire boat connections.

**Hydrants.**—*Type.*—Hydrants to be of the post type with one 4½-inch and three 2½-inch outlets; controlled by individual gates. Hydrant barrels will be not less than 9 inches in diameter; hydrant connections 8 inches in diameter, each provided with a gate valve.

*Use by Street Department.*—These hydrants are not intended for use by the street department. Provision is to be made in some cases for connecting a 3-inch street flushing hydrant to the 8-inch pipe supplying the fire hydrant.

*Distribution.*—The distribution is fairly uniform and provides one hydrant to each 50,300 square feet of area, at an average linear spacing of 160 feet. Two to four hydrants are usually located at each street intersection and the longest distance between hydrants is about 700 feet. In other words, counting three streams from each hydrant, 24 to 60 streams could be concentrated on any building in the protected district without using over 500 feet of hose on any lead.

**Operation.**—This system is to be operated by the Department of Water Supply, Gas and Electricity for at least one year after installation. It has not yet been decided what pressure will be regularly maintained on the system.

**Signal System.**—An independent telephone system will be installed to be used in connection with the high pressure system. Details have not been prepared, but the intention is to have the telephone boxes so placed that a fire in any part of the territory to be protected will be visible from at least one box, from which the pumping stations can be called up and notified as to the pressure desired.

**CONCLUSIONS.—Records.**—The incomplete and not altogether reliable condition of water department plans and other records is detrimental to an efficient management. Reform of this feature is, however, being vigorously instituted by the present chief engineer, and the available data will soon be satisfactorily recorded.

**Source of Supply.**—In view of the fact that the present, and steadily increasing, rate of consumption exceeds the safe yield of the Croton system as developed by 23,000,000 gallons per day, there is a grave danger overhanging the city of a water famine, which would be certain if a series of dry years should occur before additional supply is secured. The recent years of high rainfall have caused a want of appreciation of the seriousness of the situation, as evidenced by the dilatory methods with respect to emergency development. The benefit of the proposed new reservoirs of the Croton system will not be realized unless construction is sufficiently advanced to admit of filling reservoirs before the years of low rainfall, which are now overdue, being well known to engineers as of periodic occurrence; and even if completed in time will not increase the available supply enough to ensure safety unless the present rate of consumption is materially decreased. As the Croton system will then be developed to the utmost limit, the urgency of energetic measures toward introduction of the new Catskill supply is evident.

Structural features of existing supply works are well designed, substantially built and well maintained.

**Supply Conduits.**—While the city is practically dependent for its supply upon a single line of masonry aqueduct, it is believed that the chances of failure of a well designed and substantially built masonry structure of this kind, through the action of natural forces, are too remote to justify its duplication solely for the purpose of providing against such contingencies. Wilful injury appears to be the only menace to an aqueduct such as this and duplication would be no protection against acts of this kind. Partial duplication is, however, easily obtained through maintenance in good condition of the Old Croton aqueduct, which,

while of comparatively small capacity, would furnish material assistance in emergency, and also in connection with distributing reservoirs facilitate a more efficient maintenance of the New aqueduct, the main dependence for supply. Moreover, the increase in consumption during recent years has been such that if continued the capacity of the New aqueduct will soon be exceeded, and pending the completion of new supply works, the use of the Old aqueduct will be an absolute necessity.

**Consumption.**—Compared with other large cities the per capita consumption is not abnormally high, but present knowledge of waste and leakage shows such losses to be large. The question of waste and leakage needs more study, especially as regards the specific cause, or causes, of the excessively high minimum night rate, 82 per cent. of the mean flow at 3 to 4 o'clock in the morning. Such a condition leads naturally to the assumption that serious leaks exist and suggests the possibility through energetic measures of waste prevention and leakage reduction of husbanding reserve supply, particularly important at this time, as well as increasing pressure by reducing friction losses in the distribution system. While much of the needless waste can be stopped, this saving, if made, would not lessen the urgency of securing additional supply at the earliest possible date. The use of meters on services, which holds down the per capita consumption, has not been properly encouraged; on the contrary, it has been rather discouraged by the existing schedule of water rates.

Consumption has not been accurately determined, nor properly recorded, in the past, but a recent change in the department's methods indicates that future records will be more satisfactory.

**Pressures.**—Pressures throughout Manhattan and The Bronx, generally, are entirely too low for effective operation of sprinkler equipments, interior standpipes, and other protective devices without the use of special fire pumps. Constant pressures for fire supply of upward of 100 pounds over the greater portion of the island of Manhattan and the manufacturing and mercantile sections of The Bronx, will encourage introduction of sprinklers and other individual building protection by facilitating effective operation. The separate fire main system already authorized will provide adequate fire protection supply for one of the most important sections in Manhattan, but leaves other no less prominent sections unprovided for.

The observed pressures in the Manhattan Low service indicate, as would be expected, with the large-size main feeders, friction losses of only moderate amount under ordinary conditions of consumption. Nevertheless, the distributing reservoirs are at such low elevation that these losses of only reasonable amount make serious inroad on the all too low pressure developed by the reservoirs; this results in such low pressure over most of the island, and particularly in the more important lower portions, as to preclude the possibility of obtaining engine supply satisfactory for fighting serious fires by any practical modification or development of the present distribution system.

**Distributing Reservoirs.**—Distributing reservoirs in service hold upwards of four days' supply for the entire city. Upon the completion of the Jerome Park west basin, which is shortly expected, about one week's supply will be stored within the city limits.

**Pumping Stations.**—The Ninety-eighth street station, equipped with machinery of inferior design and further unsatisfactory through its non-fireproof construction, severe exposures and hazardous oil storage, has an important bearing on the conflagration hazard in the higher services, as in event of an interruption of service at this point the One Hundred and Seventy-ninth street station could not, while operating alone, furnish a satisfactory fire engine supply in addition to demands of maximum domestic consumption. An adequate reserve for the Upper High service is not provided at One Hundred and Seventy-ninth street, but material assistance might be obtained from the Jerome Park pumping station if suitable connections between distributing systems existed. Pending the introduction of a high level gravity supply further reserve capacity is essential and could probably be installed to the best advantage at One Hundred and Seventy-ninth street, a station of excellent construction and slight hazard, containing the best machinery of the present pumping equipment.

Incomplete records of pumping indicate an inefficient operation and maintenance, a deduction which is sustained by the fact that the department has recently instituted an investigation. The importance of the situation demands that these investigations be thorough and that the needed improvements which the investigation develops be effected at the earliest possible moment.

**Main Arteries.**—In general arterial feeders in Manhattan are of ample capacity and well distributed, but in some cases lack proper connections. The lower east side is deficient in arterial feeders and the whole section south of Central Park lacks proper cross-connections between existing mains. Conditions in the lower east side are now serious owing to the danger of almost total interruption of supply through a break in the arterial system.

In The Bronx, owing to the topography

and the scattered condition of the built-up districts, main arteries are in general long and unsupported, but in many instances could be strengthened by proper cross connections. Secondary feeders, being long and mainly 12 inch, do not properly support each other, and supply in some districts would be nearly or entirely cut off by a break in one of the feeders. The Bronx Low service is particularly deficient in arterial mains, the existing ones being almost entirely unsupported. It is recognized by the department that the distribution system in this part of the city is entirely inadequate. In the present undeveloped state of the system, it is obviously beyond the scope of the work of the National Board to make detailed recommendations. The reorganization proposed by the water department, both as to present system and future development, should be carried on in accord with the general recommendations hereinafter made.

**Minor Distributers.**—A large proportion of mains supplying hydrants, both in Manhattan and The Bronx, are of 6 inches diameter. Capacity of these small mains becomes seriously impaired with the lapse of years and their general unreliability as a dependence for fire-fighting supply has been amply demonstrated by the hydrant tests, as well as by general experience elsewhere.

**Maintenance of Distribution System.**—Until very recently, the maintenance system in vogue was criminally inadequate and inefficient. Innovations in organization and methods introduced, and under consideration, by the present chief engineer, should give better results, and this reorganization should be carried on with the greatest possible dispatch, as the present conditions leave much to be desired. The repair companies as now organized are undermanned, the force is not familiar with details of distribution system, and the department is not equipped to handle advantageously and promptly extensive breaks and other repair work of magnitude. The instructions to fire department, after a recent disastrous break, to be vigilant in locating and reporting to water department breaks in mains, will yield good results with proper co-operation between the two departments.

**Condition of Mains.**—The meagre direct evidence indicates that the older pipes are considerably corroded and tuberculated, but there is no indication of any considerable deposit of sediment in mains. There is much indirect evidence that the condition of the interior surface of old uncoated pipes, forming a considerable proportion of the whole, is productive of abnormal local friction losses; that this is so, particularly as regards the smaller sizes, was indicated by the hydrant tests. Electrolytic conditions as affecting water mains should not cause serious apprehension. Nevertheless, reported cases of electrolysis of pipes, particularly in The Bronx, are such that good practice dictates a careful survey, first at suspected points, with later extensions in accordance with findings.

**Gate Valves.**—A large proportion of the gates, particularly in the section below Forty-second street, were found upon inspection to be in poor condition. The use of valves which close by turning to the left in a system where most of the valves are right-handed cannot fail to result in dangerous delays at critical times. In general, the spacing of valves is fairly good, being such that if valves were maintained in good condition by frequent inspection the system could be considered as under fairly good control in this respect. In the past the inspection of valves has been faulty, and, especially as regards the smaller ones, is no better at the present time. Two valves were found closed at inspection, and, in view of the fact that no special precautions are taken to ensure opening of valves closed to make repairs, the conclusion is fully warranted that there are others closed unknown to the department, perhaps at important locations. The notice to the fire department of the opening and closing of valves is a matter of such moment that it should in all cases be confirmed in writing, with a permanent record kept of such notification.

**Hydrants.**—The type of hydrant generally in use is unsatisfactory, and many of them are in poor condition. Eighty-three per cent. are too small in the barrel, sixty-three per cent. have but one 2½-inch outlet, and few have more than two outlets. Many of them, especially in the lower end of Manhattan, are improperly drained, which allows water to stand in hydrants and causes frequent serious trouble by freezing. These hydrants would be unsatisfactory on a well designed and properly supplied distribution system, and their inadequacy is strongly emphasized when used in connection with the existing abnormally low water pressure.

If the combination of type of hydrant, size of main and pressure were satisfactory, the present distribution of hydrants would be good. Under existing conditions in certain localities the present hydrants will deliver all the water that the mains will furnish. In other instances, comparatively small single outlet hydrants are attached to mains of ample capacity and the amount of water that can be drawn is limited by the type of hydrant. In the first case, nothing would be gained by installing larger or additional hydrants on the present mains. In the second case, larger or additional hydrants would add directly to the amount of water available.

**Suggested Improvements.**—In view of the great extent and crowded condition of the high value district, with many adverse conditions, the most prominent of which is the abnormally low water pressure throughout, the conflagration hazard is marked. Some improvement may be effected at once by the installation of a few main feeders and attention to hydrants, as hereinafter recommended, but a satisfactory protection can be obtained only through introduction of an ample supply at high pressure. A supply will not be available at higher elevation for increased pressure for many years to come, and the construction necessary to bring the present distribution system and building plumbing into condition to withstand a considerable increase in the pressure is so great as to verge on the impossible, certainly not to be entertained if a better method can be found. Moreover, any plan involving a material increase of pressure in the present Manhattan Low service necessitates abandoning the use of three-fourths of the Croton water or pumping this enormous amount, and would require an indefinite time to complete, the city at the end being dependent still upon fire engines.

A separate high pressure fire main system will obviate the general replacement of existing small and weak mains and inferior plumbing otherwise an essentiality, and encourage the introduction of automatic sprinklers and other invaluable individual building protection by furnishing the means for effective operation in all but the highest buildings. Moreover, it will shift the dependence for protection from the comparatively inefficient fire engine to the most powerful fire-fighting machinery yet devised.

In The Bronx and those parts of Manhattan now supplied by the higher services the present supply, while far from satisfactory, is such as to admit of material immediate improvement by practical modifications of the present system pending distribution from the proposed Hill View reservoir, which, when available, will furnish adequate pressure for the greater part of this territory; but even then some of the supply will have to be pumped. The solution in detail of the problem of providing an adequate supply for fire protection involves such extended study, particularly of the economic factor, as to be obviously beyond the scope of the work of the National Board; but all future improvements and modifications of the present system should be made to conform to the eventual supply as is herein outlined.

The proposed high pressure fire system if promptly installed will afford proper protection in the near future for the district it covers, but even when extended over the territory recommended hereinafter by the National Board there will still be large values in the upper end of Manhattan and the whole of The Bronx dependent upon Croton water for fire protection, until an additional supply can be secured from the Catskills, certainly 5, and probably 8, years hence.

Believing that no policy of emergency development of sources, unless combined with stringent measures of waste prevention, will successfully tide the city over the period necessarily required for obtaining a permanent additional supply, the National Board calls particular attention to the urgent need of at once vigorously prosecuting the work of waste detection and prevention previously recommended in several reports by able engineers and reiterated in this report.

## FIRE DEPARTMENT.

**ORGANIZATION.—Basis.**—The fire department in Manhattan and The Bronx is now entirely on a full paid basis, the change from a volunteer basis having been made in Manhattan in 1865 and in The Bronx soon after the different portions of that territory were annexed.

**Supervision.**—The department is under the responsible supervision of a single fire commissioner, who is appointed by the mayor and who holds office until removed or until his successor is duly appointed and has qualified. The commissioner may be removed by the mayor whenever, in the judgment of the latter, the public interest requires it.

The commissioner appoints one or more deputy commissioners whom he may remove at will; one deputy performs such duties in the Boroughs of Brooklyn and Queens as may be directed by the fire commissioner. In the commissioner's absence a deputy has all his powers except that of making appointments.

The commissioner has power to organize such bureaus as may be advisable and to select the heads of such bureaus and their assistants. He also provides all supplies and apparatus.

FIRE COMMISSIONER AND DEPUTIES.

| | Appointed. |
|---|---|
| Commissioner, Nicholas J. Hayes | January 1, 1904 |
| Deputy Commissioner, Wm. A. Doyle (Brooklyn and Queens) | January 1, 1904 |
| Deputy Commissioner, Thos. W. Churchill | May 17, 1904 |
| Secretary to Department, Alfred M. Downes | January 1, 1904 |
| Assistant Secretary to Department, John R. Shields | August 20, 1873 |

The commissioner is usually changed with each change of administration.

**Districts.**—For fire purposes the territory included within Manhattan and The Bronx is divided into 18 battalions, each in charge of a battalion chief, in addition to the 19th battalion, comprising the five fire-boats. Battalions

are combined into five main divisions, each commanded by a deputy chief. They are bounded as follows:

*First Division.*—All territory south of a line from Houston street and East River on the east to Chambers street and North River on the west. The line runs via East Houston, Bowery, Fourth avenue, East Eighth, Broadway, Fourth street, Thompson, West Houston, Sullivan, Canal, Broadway, Chambers street, to North River. Four battalions, Nos. 1, 2, 3 and 4.

*Second Division.*—North of First Division and south of a line between Forty-second street and East River on the east and Twenty-ninth street and North River on the west, running via East Forty-second street, Park avenue, East Fifty-ninth street, Sixth avenue, West Forty-second street, Fifth avenue, West Thirty-sixth street, Eighth avenue, West Twenty-ninth street to North River. Four battalions, Nos. 5, 6, 7 and 8.

*Third Division.*—All territory east of Eighth avenue and of the Second Division from Forty-second street to the Harlem River at One Hundred and Sixty-fifth street. The line runs as follows: From East River, along East Forty-second street, Park avenue, East Fifty-ninth street, Fifth avenue, West One Hundred and Tenth street, Eighth avenue, West One Hundred and Thirty-third street, St. Nicholas avenue, Edgecombe avenue, West One Hundred and Forty-second street to a line half way between Bradhurst and Edgecombe avenues, north to the Speedway and West One Hundred and Sixty-fifth street, to the Harlem River. Blackwell's, Ward's and Randall's Islands are included in this division. Three battalions, Nos. 10, 12 and 16.

*Fourth Division.*—The remainder of Manhattan from East Twenty-ninth street to The Bronx and that part of The Bronx west of the New York & Putnam R. R., north of Kingsbridge road. Three battalions, Nos. 9, 11 and 13.

*Fifth Division.*—All of The Bronx, except the portion included in the Fourth Division. Hart's and City Islands are included in this division. Four battalions, Nos. 14, 15, 17 and 18.

| **Officers.**—*Personnel.*— | Age. | Appointed to Present Position. | Years in Service. |
|---|---|---|---|
| Chief, Edward F. Croker | 42 | 1899 | 19 |
| Deputy Chiefs (Manhattan and The Bronx): | | | |
| First Division, Chas. F. Kruger. | 54 | 1903 | 31 |
| Second " Thomas R. Langford | 41 | 1903 | 17 |
| Third " William Duane. | 64 | 1899 | 31 |
| Fourth " John Binns | 48 | 1903 | 21 |
| Fifth " Thomas J. Ahearn | 55 | 1900 | 27 |

*Chief.*—The chief is appointed by the Fire Commissioner from an eligible list of not more than three names furnished by the civil service commission. To be eligible for appointment, the chief must have served one year as deputy chief and have ranked among the first three in a competitive civil service examination. His term is indefinite, but he may be retired if found physically or mentally disqualified, and may be removed for cause after trial, such removal being subject to review by the State courts. The chief has full control of all apparatus and over all transfers, details and assignments of his subordinates, all being subject to the approval of the commissioner.

The present chief entered the department in 1884, and after nine years' service was promoted to chief of battalion. He was appointed to his present position in 1899. He is a forceful and energetic commanding officer.

*Deputy Chiefs.*—The deputy chiefs constantly inspect the districts and companies under their command, investigate all complaints, and approve charges. The deputy chiefs now in service are all experienced firemen.

*Battalion Chiefs.*—Battalion chiefs exercise direct supervision over the companies assigned to them, the number of companies varying from four to seven. They take charge at all fires in their respective districts until superseded by a superior officer.

**Membership and Salaries.**—Total membership, 2,410; fire force, 2,141.

*Fire Force.*

September, 1905.

| | Annual Salary. |
|---|---|
| 1 Chief | |
| 5 Deputy Chiefs | |
| 22 Battalion Chiefs | |
| 121 Foremen | $2,160 |
| 166 Assistant Foremen | 1,800 |
| 6 Pilots | 1,500 |
| 200 Engineers | 1,600 |
| 2 Marine Engineers | 1,400 |
| 4 Assistant Marine Engineers | 1,400 |
| 29 Stokers, 7 at | 915 |
| 29 Stokers, 22 at | 1,095 |
| 802 Firemen, 1st Grade | 1,400 |
| 138 Firemen, 2d Grade | 1,200 |
| 332 Firemen, 3d Grade | 1,000 |
| 286 Firemen, 4th Grade | 800 |
| 23 Firemen, Probationary | 800 |

*Headquarters Force.*

| | |
|---|---|
| 1 Commissioner | |
| 1 Deputy Commissioner | |
| 4 Secretaries | $2,500 to 4,800 |
| 10 Clerks, etc | 1,050 to 2,000 |
| 14 Building Attendants | 360 to 1,500 |
| 4 Medical Officers | 3,300 |
| 2 Chaplains | 1,000 |
| 6 Chief's Clerical Force | 1,050 to 2,400 |
| 1 Chauffeur | 1,200 |

*Bureau of Combustibles.*

| | | |
|---|---|---|
| 1 | Inspector of Combustibles | 3,000 |
| 14 | Oil Surveyros | 1,050 to 1,500 |
| 2 | Clerks | average 1,325 |

*Bureau of Fire Marshal.*

| | | |
|---|---|---|
| 1 | Fire Marshal | 3,000 |
| 7 | Assistant Fire Marshals | 1,500 to 2,000 |
| 2 | Clerks | average 1,350 |

*Repair Shops.*

| | | |
|---|---|---|
| 1 | Chief of Construction and Repair | 3,300 |
| 1 | Foreman of Shops | 1,560 |
| 4 | Clerks | 1,050 to 1,350 |
| 1 | Foreman Machinist | 1,248 |
| 17 | Machinists and Helpers | average 943 |
| 14 | Blacksmiths and Helpers | average 1,014 |
| 5 | Wheelwrights | 1,092 to 1,248 |
| 3 | Hose Repairers | average 938 |
| 23 | Mechanics, various | 780 to 1,248 |
| 15 | Attendants, Drivers, etc | 780 to 1,400 |
| 2 | Ship's Carpenters (on fire boats) | average 1,248 |

*Veterinary Hospital and Stables.*

| | | |
|---|---|---|
| 1 | Superintendent of Veterinary Hospital | 3,300 |
| 1 | Foreman | 1,200 |
| 16 | Drivers, Stablemen, etc | 730 to 1,000 |

*Bureau of Buildings.*

| | | |
|---|---|---|
| 1 | Superintendent | 3,000 |
| 27 | Employees | 750 to 1,950 |

*Fire Alarm.*

| | | |
|---|---|---|
| 1 | Chief Operator | 2,500 |
| 70 | Employees | 656 to 2,400 |

Members of the force assigned to service in the Boroughs of Brooklyn, Queens and Richmond are not included in the foregoing.

**Expenses.**—The expenses of the fire department, exclusive of the fire alarm system, in Manhattan and The Bronx for the years 1900 to 1903 are shown below.

| Year. | Salaries. | General Expenses. | New Apparatus. | Total. |
|---|---|---|---|---|
| 1900 | $2,201,951 | $291,849 | $85,335 | $2,579,134 |
| 1901 | 2,272,059 | 282,530 | 262,427 | 2,817,017 |
| 1902 | 2,331,868 | 335,963 | 48,435 | 2,716,266 |
| 1903 | 2,464,023 | 305,777 | 622,381 | 3,392,181 |

The expenses of the fire department in recent years have averaged between $1.25 and $1.50 per capita of population.

**Enlistment and Promotion.**—The fire commissioner makes all appointments and promotions, selecting one of the highest three candidates from eligible lists prepared by the Municipal Civil Service Commission. Candidates are examined by the commission relative to their physical development, strength and experience, as well as for general intelligence. They must be between 21 and 30 years of age and of suitable size and weight. New men serve on probation for one month in the school of instruction before final appointment, and are liable to rejection if unsatisfactory.

Promotions are made by the commissioner upon the recommendation of the chief subject to a competitive civil service examination. The rules provide that promotions shall be made one grade at a time with not less than one year's service in each grade. Engineers are appointed from first grade firemen. They are required to attend the repair shop for 30 working days, pass an examination before three fire department officials and take a civil service examination. Requirements during this training period are said to be far from strict. After certification by the examining board of the civil service commission, engineers must be examined and licensed by the sergeant in charge of the police boiler squad.

**Retirement and Pension.**—A member may be retired after 20 years' continuous service on application, by securing a certificate from the board of medical officers that he is unfit for duty. In such case he receives half-pay for life. Men totally disabled in service are similarly retired on half-pay after 10 years, and if partially disabled they are put on light service at from one-third to one-half pay. No age limit at which members must be regularly retired is set. The number of men now in service over 60 years of age is very small. Two of the chief officers are over that limit, but are still active men.

On the death of a fireman on duty his widow receives a pension of not more than half his pay and not exceeding $1,000 per year; dependent parents or children receive not more than $500 per year. If death did not occur in the line of service, widows and children may each be paid not over $300 each per annum. A death benefit of $1,000 is also paid to the heirs of every deceased member. The death benefits are paid from an insurance fund supported by assessments on all uniformed members of the department and all pensioners. Relief is also provided from the Exempt Firemen's Benevolent Fund, which receives the income from a tax of 2 per cent. on foreign insurance companies for all business done in the city. The amounts collected through the 2 per cent. tax in all five boroughs since 1900 has increased from $69,674 in 1901 to $205,430 in 1904. The total disbursements for pensions and relief in 1903 amounted to $383,147 in Manhattan and The Bronx.

**Companies.**—*Number.*—On October 1, 1905, there were in service 110 fire companies di-

vided on the fire department rolls into 82 engine companies and 28 ladder companies. These may be further classified as follows:

Single engine companies, 52; double engine companies, 12; combined engine and ladder companies, 11; total companies with steam fire engines, 75.

Single ladder companies, 23; double ladder companies, 5; combined engine and ladder companies, 11; total ladder companies, 39.

Fire-boat companies, 5.

Chemical companies, 2.

In addition to the foregoing, 4 water towers, 2 search light engines and 3 fire-boat tenders are stationed with and are manned by the foregoing companies.

*Organization.*—Each company is composed of from 8 to 34 members, all except the two chemical companies having at least 12 men permanently attached.

The usual strength of the single engine companies is from 14 to 17 men; the single ladder companies have 15, 17 or 18 members, and the double companies, both engine and ladder, have from 23 to 27 members. The fire boats are manned by crews of from 25 to 34 men. The four water towers are handled by three or four members of the companies with which they are stationed. Two men are detailed from the company in quarters to take charge of the searchlight engines. The three fire-boat tenders are each driven by a single man. The strength of all the companies in service is shown in the following table, which gives the number of companies of each type manned by crews of different strengths:

STRENGTH OF COMPANIES.

(See also Tables Nos. 13 and 14.)

| Men per Company. | Engine Companies. (Single.) | Ladder Companies. (Single.) | Combined Engine and Ladder Companies. |
|---|---|---|---|
| 12 or less | 4 | 0 | 0 |
| 13 or 14 | 14* | 1* | 3 |
| 15 or 16 | 18 | 8* | 4 |
| 17 or 18 | 13* | 11 | 4 |
| 19, 20, 21 | 5* | 2* | |
| Total Companies | 54 | 23 | 11 |
| | Double Engine Companies. | Double Ladder Companies. | Fire Boat Companies. |
| 21 to 24 | 3 | 3 | |
| 25 to 29 | 8 | 3† | 3 |
| 32 to 34 | 1* | | 2 |
| Total Companies | 12 | 5 | 5 |

* One water tower, chemical engine or searchlight engine is stationed with one of these companies.

† Includes ladder company No. 24, a single company in charge of ladder, water tower and searchlight engine.

The two chemical companies, with eight and nine men respectively, are included under engine companies.

Each single engine company usually consists of ten to fourteen hosemen (firemen), two engineers, and an assistant foreman, under the command of a captain (foreman). Many companies at important locations have two assistant foremen, and several include three engineers. The number of engineers in other companies is sometimes reduced to one, eleven companies being on a single engineer basis on July 31, 1905. The double engine companies

TABLE No. 13.—WORKING STRENGTH OF FIRE COMPANIES.

| Companies. | Number of Men in Attendance per Company. | | | | | | | | | | | Average Men per Company at Each Fire. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 20 engine companies below 42d Street... | ..... | 2 | 71 | 104 | 75 | 47 | 34 | 21 | 19 | 3 | ..... | 9 |
| 11 engine companies above 59th Street.. | ..... | 1 | 60 | 71 | 19 | 22 | 25 | 9 | 2 | ..... | 1 | 8.6 |
| 6 engine companies in The Bronx..... | 1 | 2 | 38 | 26 | 18 | 6 | 9 | ..... | ..... | ..... | ..... | 8.1 |
| 6 ladder companies below 42d Street... | 1 | 3 | 49 | 27 | 19 | 18 | 12 | 5 | ..... | 2 | 1 | 8.6 |
| 6 ladder companies above 59th Street... | ..... | 12 | 33 | 32 | 15 | 11 | 11 | 9 | ..... | 1 | ..... | 8.4 |
| 3 ladder companies in The Bronx..... | ..... | 1 | 26 | 10 | 8 | 9 | 5 | 1 | ..... | ..... | ..... | 8.4 |

have each a second assistant foreman and, as a rule, four engineers. A large proportion of the ladder companies, including those in charge of water towers, searchlights, etc., consist of one foreman, two assistant foremen, and from 11 to 18 firemen. The double companies also consist of 3 officers and firemen not exceeding 22.

*Maintenance.*—The downtown engine companies usually consist of 17 or 18 men, which, with at least one-fifth always absent on days off and other men absent on leave and meal hours, brings the working force during meal hours down to 8 men and frequently to 7 men. One officer and one engineer are required to be always at quarters, being detailed from other companies in the same battalion when necessary. With seven men in quarters, including one officer, engineer and two drivers, there are three men present for hose duty. Single company apparatus occasionally responds with six men, and the second sections of the double companies are usually limited to that strength.

The number of men per company in attendance at fires is shown in Table No. 13. The figures give the number of times individual companies responded with 15 men or less during February, 1905. No company had more than 15 men in attendance.

From Table No. 13 it appears that in 177 cases out of 376, or over 45 per cent., downtown engine companies responded with less than nine men in attendance, the number in 73 cases being seven men or less.

*Distribution.*—Engine companies are distributed throughout Manhattan at comparatively short intervals in the southern part, the spaces between companies becoming wider as the distance north increases. Within a radius of one-half mile of City Hall are stationed eight engine companies and three ladder companies; three additional engine and two ladder companies are within a radius of three-quarters of a mile. In general, from one to eight engine companies will be found within a radius of three-quarters of a mile of any point south of Fourteenth street, the usual number inside this distance being 3, 4 or 5. From Fourteenth street to Forty-second a three-quarter mile radius will include from one to five engines, the usual number being two or three, and in some large spaces only one engine company is stationed. On the east side above Forty-second street and south of One Hundred and Tenth street, not more than three engines are within three-quarters of a mile of any spot, and some areas are without any engine companies within this radius. On the west side the distribution is slightly closer, some locations being within three-quarters of a mile of four engine companies and most of the territory either having two or three companies within that radius. North of One Hundred and Tenth street the distribution is in general similar to that on the west side between Forty-second and One Hundred and Tenth streets, except that the protection north of One Hundred and Forty-fifth street is limited at present to two engine and no ladder companies. As a rule, the number of ladder companies in any locality is about half that of the engine companies, but the ladder companies promptly available for the protection of the six miles or more of the west side north of West Ninety-eighth street are limited to a single company at One Hundred and Fortieth street.

At several points in Manhattan the distance to the nearest engine company exceeds half a mile. A list of such localities is shown below.

| Locality. | Distance to Nearest Company. | |
|---|---|---|
| | Engine Company, Feet. | Ladder Company, Feet. |
| Rutgers Slip | 2,700 | 2,400 |
| Corlears and Water Sts. | ..... | 3,700 |
| Clinton Market, W. side | ..... | 2,700 |
| W. Washington Market | ..... | 3,000 |
| 14th St. and East River | 2,700 | 2,900 |
| W. 23d St. and 13th Ave. | 2,900 | 4,700 |
| E. 34th St. and 1st Ave. | 2,800 | 2,600 |
| E. 34th St. and 4th Ave. | 3,300 | ..... |
| E. 57th St. and Ave. A. | 3,800 | 4,400 |
| W. 57th St. and 12th Ave. | 4,100 | 5,900 |
| W. 65th St. and Broadway | ..... | 3,500 |
| E. 80th St. and Ave. B | 3,800 | 5,000 |
| W. 87th St. and Broadway | ..... | 2,700 |
| W. 93d St. and Broadway | 3,300 | ..... |
| E. 95th St., several locations | 3,000 | 3,000 |
| Columbia University | ..... | 5,000 |
| E. 111th St. and 1st Ave. | 3,300 | ..... |
| W. 121st St. and 8th Ave. | 2,800 | 4,400 |
| W. 150th St. and 8th Ave. | 3,200 | ..... |
| W. 160th St. and Amsterdam Ave. | ..... | 5,300 |
| W. 201st St. and Amsterdam Ave. | 8,000 | 14,000 |

The foregoing locations include several among dangerous conflagration districts, one or more near the dry goods district and several along the river fronts. The last, particularly on the recently built-up upper east side and the west side above One Hundred and Fortieth street, is deficient in protection. Four of the five fire boats are stationed south of Fourteenth street, with the fifth on the East River at Ninety-ninth street. The North River north of Thirteenth street is without fire boat protection. Companies in The Bronx are stationed generally about a mile or more apart. This distance is reduced in Morrisania.

## TABLE NO 14.—FIRE COMPANIES—LOCATION AND EQUIPMENT.

### ENGINE COMPANIES.

| Company. | Location. | Men. | Size Engine. | Type of Wagon. | Hose Carried (2½"), Feet. | Ladders Carried. | Chemical Extinguishers. |
|---|---|---|---|---|---|---|---|
| Engine 1. | W. 29th St., near 7th Ave..... | 15 | First. | Plain. | 1,200* | 1—14′ | None. |
| Engine 2. | W. 43d St., near 11th Ave..... | 17 | First. | Plain. | 1,200* | 2—14′ | " |
| Engine 3. | W. 17th St., near 9th Ave..... | 14 | Second. | Plain. | 1,150* | 2—14′ | " |
| Engine 4. | Maiden Lane, near Pearl St..... | 16 | First. | Plain. | 1,100* | 2—14′ | " |
| Engine 5. | E. 14th St., near 1st Ave..... | 28 | First. | Plain. | 1,000* | 2—14′ | " |
| | (Double company)..... | ..... | Fourth. | Plain. | 1,050 | 2—14′ | " |
| Engine 6. | Liberty St., near Church St..... | 19 | Third. | Plain. | 1,000 | 1—18′ | " |
| Engine 7. | Beekman St., near William St... | 17 | First. | Plain. | 1,000* | 2—14′ | " |
| Engine 8. | E. 51st St., near 3d Ave..... | 19 | First. | Plain. | 1,100* | 2—14′ | " |
| Engine 9. | East Broadway, near Market St. | 18 | First. | Plain. | 1,100* | 2—14′ | " |
| Engine 10. | Stone St., near Whitehall..... | 16 | First. | Plain. | 1,100* | 2—14′ | " |
| Engine 11. | E. Houston St., nr. Manhattan St. | 18 | Second. | Plain. | 1,100* | 2—14′ | " |
| Engine 12. | William St.,nr.New Chambers St. | 23 | First. | Plain. | 1,000* | 2—14′ | " |
| | (Double company)..... | ..... | Fourth. | Reel. | 700 | None. | " |
| Engine 13. | Wooster St., near Spring St..... | 25 | First. | Plain. | 1,150* | 2—14′ | " |
| | (Double company)..... | ..... | Fourth. | Plain. | 1,050* | 2—14′ | " |
| Engine 14. | E. 18th St., near Broadway..... | 18 | First. | Plain. | 1,300* | 2—14′ | " |
| Engine 15. | Henry St., near Gouverneur..... | 14 | First. | Plain. | 1,000* | 2—14′ | " |
| Engine 16. | E. 25th St., near 3d Ave..... | 27 | Second. | Plain. | 1,150* | 2—14′ | " |
| | (Double company)..... | ..... | Fourth. | Plain. | 900 | 2—14′ | " |
| Engine 17. | Ludlow St., near Delancey St.... | 15 | Third. | Plain. | 800 | 1—14′ | " |
| Engine 18. | W. 10th St., near Greenwich St. | 26 | First. | Plain. | 1,300* | 2—14′ | " |
| | (Double company)..... | ..... | Fourth. | Plain. | 1,000 | 1—14′ | " |
| Engine 19[c]. | W. 25th St., near 9th Ave..... | 18 | First. | Plain. | 1,100* | 2—14′ | " |
| Engine 20[d]. | Marion St., near Spring St..... | 19 | First. | Plain. | 1,150* | 2—14′ | " |
| Engine 21. | E. 40th St., near 3d Ave..... | 20 | First. | Plain. | 1,000* | 2—14′ | " |
| Engine 22. | E. 85th St., near Lexington Ave. | 18 | Second. | Plain. | 1,000* | 2—14′ | " |
| Engine 23. | W. 58th St., near Broadway. .... | 18 | Third. | Plain. | 1,150* | 2—14′ | " |
| Engine 24. | Morton St., near Hudson St..... | 15 | First. | Plain. | 1,200* | 1—14′ | 1—3 gal. |
| Engine 25. | Fifth St., near Second Ave..... | 16 | First. | Plain. | 1,100* | 2—14′ | None. |
| Engine 26. | W. 37th St., near 7th Ave..... | 26 | First. | Plain. | 1,100* | 2—14′ | " |
| | (Double company)..... | ..... | Fourth. | Plain. | 1,000 | 2—14′ | " |
| Engine 27. | Franklin St., near Greenwich St.. | 21 | First. | Plain. | 1,350* | 2—14′ | " |
| | (Double company)..... | ..... | Fourth. | Reel. | 1,000 | None. | " |
| Engine 28. | E. 11th St., near Ave. B..... | 15 | Second. | Plain. | 1,150* | 2—14′ | " |
| Engine 29. | Chambers St., near W. Broadway | 16 | First. | Plain. | 1,250* | 2—14′ | " |
| Engine 30. | Spring St., near Hudson St..... | 26 | First. | Plain. | 1,400* | 2—14′ | " |
| | (Double company)..... | ..... | First. | Plain. | 1,100 | 2—14′ | " |
| Engine 31[c]. | Cor. White and Elm Sts..... | 32 | First. | Plain. | 1,100* | 2—14′ | " |
| | (Double company)..... | ..... | Second. | Plain. | 1,100* | 1—14′ | " |
| Engine 32. | John St., opposite Cliff St..... | 16 | Second. | Plain. | 1,000 | 2—14′ | " |
| Engine 33. | Great Jones St., near Bowery.... | 26 | First. | Plain. | 1,300* | 2—14′ | " |
| | (Double company)..... | ..... | Second. | Plain. | 1,100* | 2—14′ | " |
| Engine 34. | W. 33d St., near 9th Ave..... | 13 | First. | Plain. | 1,300* | 2—14′ | " |
| Engine 35. | E. 119th St., near 3d Ave..... | 15 | Second. | Plain. | 1,200 | 2—14′ | " |
| Engine 36. | Park Ave., near E. 127th St..... | 14 | Third. | Plain. | 950 | 2—14′ | " |
| Engine 37. | Lawrence St.,cor.Amsterdam Ave. | 14 | Fourth. | Plain. | 1,000 | 2—14′ | " |
| Engine 38. | Amsterdam Ave , nr. W. 154th St. | 13 | Fourth. | Plain. | 1,000 | 2—14′ | " |
| Engine 39 | E. 67th St., near 3d Ave..... | 19 | Third. | Plain. | 1,100 | 2—14′ | " |
| Engine 40. | W. 68th St., near 10th Ave..... | 14 | Third. | Plain. | 1,050 | 2—14′ | " |
| Engine 41. | E. 150th St., nr. Courtlandt Ave. | 15 | Third. | Plain. | 1,000 | 2—14′ | " |
| Engine 42. | Fulton Ave., near E. 168th St.. | 14 | Fourth. | Plain. | 1,000 | 2—14′ | " |
| Engine 43[a]. | Sedgwick Ave., nr. Burnside Ave. | 17 | Fourth. | Plain. | 1,100 | None. | " |
| Engine 44. | E. 75th St., near 3d Ave..... | 15 | Second. | Plain. | 1,050 | 2—14′ | " |
| Engine 45[a]. | Tremont Ave., near Daly Ave.. | 14 | Second. | Plain. | 1,000 | 2—14′ | " |

TABLE No. 14.—FIRE COMPANIES—LOCATION AND EQUIPMENT—(*Continued*).

ENGINE COMPANIES.

| Company. | Location. | Men. | Size Engine. | Type of Wagon. | Hose Carried (2½") Feet. | Ladders Carried. | Chemical Extinguishers. |
|---|---|---|---|---|---|---|---|
| Engine 46. | E. 176th St., nr. Park Ave., Bronx | 15 | Third. | Plain. | 1,000 | 2—14′ | None. |
| Engine 47. | W. 113th St., nr. Amsterdam Ave. | 17 | Second. | Plain. | 1,100 | 2—14′ | " |
| Engine 48[a] | Webster Ave., near E. 189th St.. | 15 | Fourth. | Plain. | 1,100 | 2—14′ | " |
| Engine 49[ab] | Blackwell's Island..... | 17 | Fourth. | Reel. | 1,100 | None. | " |
| | " " ..... | | Second. | Plain. | 1,250 | " | " |
| | Randall's " ..... | | Second. | Reel. | 2,500 | " | " |
| | " " ..... | | Second. | Reel. | | " | " |
| | Ward's " ..... | | Third. | Reel. | | " | " |
| | " " ..... | | Second. | Reel. | | " | " |
| Engine 50[a] | E. 166th St., nr. Washington Ave. | 18 | Third. | Plain. | 1,100 | 2—14′ | " |
| Engine 51. | East River, at 99th St..... | 29 | Fireboat. | ..... | 3,100 † | 2— | " |
| Engine 52[a] | Riverdale Ave., Bronx ..... | 15 | Fifth. | Plain. | 1,000 | None. | " |
| Engine 53[c]. | E. 104th St., near 3d Ave..... | 15 | Third. | Plain. | 1,000 | 2—14′ | " |
| Engine 54. | W. 47th St., near 8th Ave..... | 17 | First. | Plain. | 1,200 * | 2—14′ | " |
| Engine 55. | Broome St., near Elizabeth St.... | 16 | First. | Plain. | 1,150 * | 2—14′ | " |
| Engine 56. | W. 83d St., near 9th Ave..... | 12 | Third. | Plain. | 1,000 | 2—14′ | " |
| Engine 57. | N. Y. Harbor, at the Battery..... | 34 | Fireboat. | ..... | 3,450 † | 2—12′ | " |
| Engine 58. | W. 115th St., near Lenox Ave... | 13 | Third. | Plain. | 1,050 | 2—14′ | " |
| Engine 59. | W. 137th St., near 7th Ave..... | 15 | Third. | Plain. | 1,000 | 2—14′ | " |
| Engine 60. | E. 137th St., near Alexander Ave.. | 17 | Third. | Plain. | 1,100 | 2—14′ | " |
| Engine 61. | Main St., near Poplar St., Westchester..... | 15 | Fourth. | Combin. | 1,100 | 1—16′ | 1—60 |
| Engine 62[a] | White Plains Rd., nr. Gun Hill Rd. | 15 | Fourth. | Plain. | 800 | 2—14′ | None. |
| Engine 63. | 240th St., near White Plains Rd.. | 9 | None. | Combin. | 1,000 | 1—16′ | 1—60-gal. |
| Engine 64. | 12th St., near Ave. C, Unionport. | 8 | " | Combin. | 1,100 | 2—14′ | 1—60-gal. |
| Engine 65. | W. 43d St,, near 5th Ave..... | 17 | First. | Plain. | 1,100* | 2—14′ | None. |
| Engine 66. | East River at Grand St..... | 27 | Fireboat. | ..... | 3,850† | 2— | " |
| Engine 67. | W. 170th St. nr. Amsterdam Ave. | 13 | Fourth. | Plain. | 1,150 | 1—16′ | 1— 2-gal. |
| Engine 68[a] | Ogden Ave., near W. 165th St., | 17 | Fourth. | Plain. | 1,000 | 3—14′ | None. |
| Engine 69[a] | W. 233d St., near Keppler Ave.. | 14 | Fifth. | Plain. | 1,000 | 1—16′ | " |
| Engine 70[a] | Schofield St., City Island, Bronx. | 13 | Fourth. | Combin. | 1,150 | None. | 1—60-gal. |
| | Hart's Island, " | | Second. | 2 Reels. | 800 | " | None. |
| Engine 71. | Park Ave. and E. 159th St. " | 14 | Fourth. | Plain. | 1,000 | 2—14′ | " |
| Engine 72. | E. 12th St., near 5th Ave..... | 18 | First. | Plain. | 1,250* | 2—14′ | " |
| Engine 73. | E. 152d St. and Prospect Ave.. | 14 | Fourth. | Plain. | 1,000 | 2—14′ | " |
| Engine 74. | W. 77th St., near Broadway..... | 16 | Third. | Plain. | 1,000 | 2—14′ | " |
| Engine 75[a] | Jerome Ave., near W. 183d St. . | 16 | Fourth. | Plain. | 1,000 | 2—14′ | " |
| Engine 76. | W. 102d St., near 9th Ave..... | 22 | Second. | Plain. | 1,000 | 2—14′ | " |
| | (Double Company) ..... | | Second. | Plain. | 1,000 | 1—14′ | " |
| Engine 77. | East River at Main St., Bklyn.... | 25 | Fireboat. | ..... | 2,400† | 2— | " |
| Engine 78. | North River at 13th St..... | 34 | Fireboat. | ..... | 2,250† | 2— | " |
| Engine 79[b] | Briggs Ave. near E. 200th St.. | 14 | Fourth. | Plain. | 1,000 | 2—14′ | " |
| Engine 80. | W. 139th St., nr. Amsterdam Ave. | 25 | Third. | Plain. | 900 | 2—14′ | " |
| | (Double Company)..... | | Third. | Plain. | 800 | 2—14′ | " |
| Engine 81. | Albany Ave., Kingsbridge, Bronx. | 14 | Fourth. | Plain. | 1,000 | 1—14′ | " |
| Engine 82. | Intervale Ave., near E. 169th St.. | 12 | Third. | Plain. | 1,000 | 2—14′ | " |

* Includes both 3-inch and 2½-inch hose. Wagons not equipped with 3-inch hose usually carry from 300 to 500 feet of 1½-inch hose.

† Includes 2½-inch hose and larger sizes.

*a*. Combination company, engine and ladder truck. See Ladder Companies.

*b*. Combination company, engine and chemical. See Chemical Engines.

*c*. Combination company, engine and water tower. See Water Towers.

*d*. Combination company, in charge of search-light engine.

*e*. Boat tender in quarters.

TABLE No. 14.—FIRE COMPANIES—LOCATION AND EQUIPMENT.—(*Continued.*)

LADDER COMPANIES.

| Companies. | LOCATION. | Men. | Type of Ladder Truck. | Put in Service. | LADDERS CARRIED. | | Chemical Extinguishers. |
|---|---|---|---|---|---|---|---|
| | | | | | Number. | Total Length, Feet. | |
| Ladder 1.... | Chambers, cor. Centre St..... | 18 | Ordinary. | 1892 | 15 | 429 | 2—3 gallon. |
| Ladder 2.... | E. 50th St., cor. Lexington Ave | 19 | Dederick 75' Aerial. | 1903 | 12 | 293 | 2—3 gallon. |
| Ladder 3[c]... | E. 13th St., near 4th Ave..... | 21 | Dederick 75' Aerial. | 1902 | 12 | 330 | 2—3 gallon. |
| Ladder 4.... | Cor. 8th Ave. and 48th St..... | 18 | Hayes 85' Aerial. | 1893 | 16 | 420 | 2—3 gallon. |
| Ladder 5.... | Charles, near Hudson St..... | 24 | Ordinary. | 1890 | 14 | 290 | 2—3 gallon. |
| | (Double Company)..... | | " | 1893 | 18 | 460 | 2—3 gallon. |
| Ladder 6.... | Canal, near Allen St..... | 15 | Babcock 75' Aerial. | 1900 | 14 | 373 | 4—3 gallon. |
| Ladder 7.... | E. 28th St., near 3d Ave..... | 17 | Dederick 75' Aerial. | 1903 | 14 | 421 | 2—3 gallon. |
| Ladder 8.... | N. Moore and Varick Sts..... | 17 | Ordinary. | 1892 | 14 | 395 | 2—3 gallon. |
| Ladder 9.... | Elizabeth, near Prince St..... | 18 | Hayes 75' Aerial. | 1888 | 14 | 373 | 2—3 gallon. |
| Ladder 10[c]... | Fulton, near Church St..... | 18 | Ordinary. | 1894 | 16 | 424 | 2—3 gallon. |
| Ladder 11.... | E. 5th St., near Avenue D..... | 17 | " | 1895 | 15 | 421 | 2—3 gallon. |
| Ladder 12... | W. 21st St., near 7th Ave..... | 18 | Hayes 85' Aerial. | 1886 | 15 | 403 | 2—3 gallon. |
| Ladder 13... | E. 87th St., near Lexington Ave.. | 17 | Dederick 85' Aerial. | 1901 | 14 | 390 | 2—3 gallon. |
| Ladder 14... | E. 125th St., near Lexington Ave. | 17 | Dederick 75' Aerial. | 1903 | 14 | 311 | 2—3 gallon. |
| Ladder 15... | Old Slip, near Water St ..... | 18 | Hayes 85' Aerial. | 1900 | 15 | 385 | 2—3 gallon. |
| Ladder 16... | E. 67th St., near 3d Ave..... | 15 | Dederick 85' Aerial. | 1900 | 15 | 406 | 2—3 gallon. |
| Ladder 17... | E. 143d St., near 3d Ave... .... | 16 | Dederick 65' Aerial. | 1898 | 12 | 314 | 2—3 gallon. |
| Ladder 18... | Attorney, near Delancey St..... | 15 | Ordinary. | 1878 | 14 | 374 | 2—3 gallon. |
| Ladder 19[b].. | Forest Ave., near 161st St..... | 16 | Ordinary. | 1893 | 11 | 261 | 2—3 gallon. |
| Ladder 20... | Mercer, near Prince St..... | 27 | Dederick 89' Aerial. | 1897 | 13 | 383 | 2—3 gallon. |
| | (Double Company)..... | | Hayes 85' Aerial. | 1887 | 13 | 385 | 2—3 gallon. |
| Ladder 21... | W. 36th St., near 10th Ave..... | 29 | Dederick 85' Aerial | 1902 | 12 | 350 | 2—3 gallon. |
| | (Double Company)..... | | Ordinary. | 1869 | 13 | 350 | 2—3 gallon. |
| Ladder 22... | Amsterdam Ave., near 97th St.. | 24 | Seagrave 75' Aerial. (Quick-raising.) | 1902 | 13 | 343 | 2—3 gallon. |
| | (Double Company)..... | | Ordinary. | 1894 | 11 | 273 | 2—3 gallon. |
| Ladder 23[b].. | W. 140th St.,near Amsterdam Ave | 13 | Ordinary. | 1898 | 12 | 290 | 2—3 gallon. |
| Ladder 24[cd].. | W. 33d St., near 6th Ave..... | 25 | Dederick 85' Aerial. | 1901 | 14 | 399 | 2—3 gallon. |
| Ladder 25.. | W. 77th St., near Broadway.... | 15 | Am. La F.75' Aerial. (Quick-raising.) | 1505 | 14 | 359 | 2—3 gallon. |
| Ladder 26[c].. | E. 114th St., near Madison Ave.. | 16 | Seagrave 85' Aerial. (Quick-raising.) | 1902 | 14 | 390 | 2—3 gallon. |
| Ladder 27... | E. 176th St., near Park Ave..... | 15 | Ordinary. | 1881 | 12 | 371 | 2—3 gallon. |
| Ladder 28... | W. 143d St., near 8th Ave..... | 23 | Ordinary. | 1872 | 13 | 292 | 2—3 gallon. |
| | (Double Company)..... | | Ordinary. | 1868 | 13 | 292 | 2 3—gallon. |

LADDER TRUCKS WITH COMBINATION COMPANIES.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Engine 43[a]... | Sedgwick & Burnside Avenues. . | (*) | Ordinary. | 1896 | 6 | 140 | 2—2-gallon. |
| Engine 45[a]... | Tremont Ave., near Daly Ave... | (*) | Ordinary. | 1895 | 8 | 170 | 2—2-gallon. |
| Engine 48[a]... | Webster Ave., near 118th St..... | (*) | Ordinary. | 1898 | 9 | 274 | 2—2-gallon. |
| Engine 49[ab].. | Blackwell's Island..... | (*) | Ordinary. | 1864 | 9 | 265 | 1—6 gallon. |
| | Ward's Island.. .... ..... | (*) | 2 Hand Trucks. | 1894 | Few | ..... | ..... |
| | Randall's Island..... | (*) | 2 Hand Trucks. | 1895 | Few | ... .... | ..... |
| Engine 50[a]... | E. 166th St., nr. Washington Ave. | (*) | Ordinary. | 1882 | 9 | 216 | 2—3-gallon. |
| Engine 52[a]... | Riverdale Ave., Bronx..... | (*) | Ordinary. | 1895 | 5 | 130 | 2—2-gallon. |
| Engine 62[a]... | 36 White Plains R'd. W'msbridge | (*) | Ordinary. | 1896 | 11 | 216 | 2—2-gallon. |
| Engine 68[a]... | Ogden Ave., near 165th St. ... | (*) | Ordinary. | 1898 | 10 | 198 | 2—3-gallon. |
| Engine 69[a]... | 233d St..... | (*) | Ordinary. | 1899 | 7 | 150 | 2—2-gallon. |
| Engine 70[a]... | Schofield St., City Island..... | (*) | Ordinary. | 1899 | 6 | 140 | 2—2-gallon. |
| Engine 75[a]... | Jerome Ave., near 183d St..... | (*) | Ordinary. | 1885 | 9 | 192 | 2—2-gallon. |

TABLE No. 14.—FIRE COMPANIES—LOCATION AND EQUIPMENT—(*Continued.*)

SPARE LADDER TRUCKS.

| Companies. | Location. | Type of Ladder Truck. | Put in Service. | Ladders Carried. | | Chemical Extinguishers. |
|---|---|---|---|---|---|---|
| | | | | Number. | Total Length, Feet. | |
| Spare..... | 4th Battalion. | Ordinary. | 1892 | 12 | 365 | |
| Spare..... | 12th Battalion. | Ordinary. | 1872 | 7 | 217 | |
| Spare..... | 12th Battalion. | ..... | ..... | 5 | 175 | |
| Spare..... | 15th Battalion. | Ordinary. | 1883 | 5 | 135 | 2—2-gallon. |
| Spare..... | 15th Battalion. | Ordinary. | ..... | 5 | 100 | |
| Spare..... | Fuel Depot 4. | Hayes 85' Aerial. | 1891 | 7 | 270 | |

* Manned by members of engine company.
*a* Combination company, engine and ladder. See engine companies.
*b* Combination company, ladder and chemical. See chemical engines.
*c* Combination company, ladder and water tower. See water towers.
*d* Combination company, in charge of search-light engine.
*e* Boat tender in quarters.

CHEMICAL ENGINES.

| Company. | Location. | Men. | Type. | Make. | Put in Service. | Tanks. | Size Each Tank. |
|---|---|---|---|---|---|---|---|
| Engine 49. | Blackwell's Island..... | * | Hand. | Babcock. | Unknown. | 1 | 60 gallons. |
| | Blackwell's Island..... | * | Hand. | Babcock. | Unknown. | 1 | 60 gallons. |
| | Blackwell's Island..... | * | Hand. | Babcock. | 1873 | 2 | 60 gallons. |
| | Randall's Island..... | * | Hand. | Babcock. | 1873 | 2 | 60 gallons. |
| Engine 79. | Briggs Avenue (Bronx)..... | * | Horse. | Babcock. | 1898 | 2 | 50 gallons. |
| Reserve... | With Ladder 23..... | 0 | Horse. | Holloway. | 1898 | 2 | 50 gallons. |
| Reserve... | With Ladder 19..... | 0 | Horse. | Babcock. | 1886 | 2 | 60 gallons. |

WATER TOWERS.

| Company. | Location. | Men. | Type. | Height Extended. | Put in Service. | Turret Nozzles. | Number of Inlets. |
|---|---|---|---|---|---|---|---|
| Tower 1... | With Engine Co. 31..... | 3* | Hale. | 64 ft. | 1900 | 1 | 10 |
| Tower 2... | With Ladder Co. 3..... ..... | 4* | Hale. | 62 ft. | 1898 | 1 | 10 |
| Tower 3... | With Ladder Co. 24..... ..... | 4* | Hale. | 62 ft. | 1904 | 1 | 10 |
| Tower 4... | With Ladder Co. 26..... | 4* | Hale. | 58½ ft. | 1895 | 1 | 10 |
| Reserve... | With Engine Co. 31..... | 0 | Hale. | 64 ft. | 1890 | 1 | 10 |

* Manned by members of other company in quarters.

TABLE NO. 15.—STEAM FIRE ENGINES.

| Engine No. | Make. | Size. | Put in Service. | Horses. | Renewals. | Diameter, Inches. | | Stroke, Inches. | Capacity, Gallons per Minute. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Cylinder. | Pump. | | Rated. | At Test. |
| 1 | Metropolitan. | First. | 1898 | 3 | ..... | 9 | 5½ | 8 | 900 | |
| 2 | Metropolitan. | First. | 1897 | 3 | ..... | 9 | 5½ | 8 | 900 | 776 |
| 3 | La France. | Second. | 1892 | 3 | ..... | 8¼ | 4¼ | 8 | 700 | |
| 4 | Metropolitan. | First. | 1899 | 3 | ..... | 9 | 5⅛ | 8 | 900 | |
| 5*a* | Clapp & Jones. | First. | 1904 | 3 | ..... | 9 | 5⅛ | 8 | 900 | 870 |
| 5*b* | Clapp & Jones. | 4th Single. | 1881 | 2 | Fox boiler 1896. | 9¼ | 5⅛ | 6 | 400 | |
| 6 | La France. | Third. | 1900 | 2 | ..... | 7⅜ | 4¼ | 8 | 600 | |
| 7 | Clapp & Jones. | First. | 1880 | 3 | Rebuilt 1894. | 8 | 5 | 7 | 800 | |
| 8 | Metropolitan. | First. | 1900 | 3 | ..... | 9 | 5⅛ | 8 | 900 | |
| 9 | American. | First. | 1896 | 3 | ..... | 9 | 5⅛ | 8 | 900 | |
| 10 | American. | First. | 1897 | 3 | ..... | 9 | 5⅛ | 8 | 900 | |
| 11 | La France. | Second. | 1893 | 3 | New pumps 1896. | 8¼ | 4⅜ | 8 | 700 | 389 |
| 12*a* | La France. | First. | 1900 | 3 | ..... | 8¾ | 5¼ | 9 | 900 | |
| 12*b* | Clapp & Jones. | 4th Single. | 1881 | 2 | La France boiler 1896. | 9¼ | 5½ | 6 | 400 | |
| 13*a* | Metropolitan. | First. | 1900 | 3 | ..... | 9 | 5½ | 8 | 900 | 525* |
| 13*b* | Clapp & Jones. | 4th Single. | 1884 | 2 | La France boiler 1898. | 9¼ | 5⅛ | 6 | 400 | |
| 14 | La France. | First. | 1894 | 3 | ..... | 8¾ | 5 | 9 | 900 | |
| 15 | La France. | First. | 1894 | 3 | ..... | 8¾ | 5 | 9 | 900 | |
| 16*a* | La France. | Second. | 1892 | 3 | ..... | 8¼ | 4¾ | 8 | 700 | 421 |
| 16*b* | Clapp & Jones. | 4th Single. | 1884 | 2 | La France boiler 1898. | 9¼ | 5⅛ | 6 | 400 | |
| 17 | Metropolitan. | Third. | 1900 | 3 | ..... | 7⅛ | 4⅛ | 7 | 600 | |
| 18*a* | Nott. | First. | 1903 | 3 | ..... | 10 | 5⅝ | 8 | 1,000 | 619 |
| 18*b* | Clapp & Jones. | 4th Single. | 1884 | 2 | Fox boiler 1898. | 9¼ | 5½ | 6 | 400 | 274 |
| 19 | Metropolitan. | First. | 1899 | 3 | ..... | 9 | 5½ | 8 | 900 | |
| 20 | Metropolitan. | First. | 1905 | 3 | ..... | 9 | 5⅛ | 8 | 900 | |
| 21 | Clapp & Jones. | First. | 1892 | 3 | ..... | 9 | 5⅛ | 8 | 900 | |
| 22 | La France. | Second. | 1888 | 3 | Rebuilt 1899. | 7¾ | 4⅜ | 8 | 700 | |
| 23 | La France. | Third. | 1895 | 3 | ..... | 7⅜ | 4¼ | 8 | 600 | |
| 24 | La France. | First. | 1896 | 3 | ..... | 8¾ | 5¼ | 9 | 900 | |
| 25 | Clapp & Jones. | First. | 1882 | 3 | New boiler 1895. | 8⅛ | 5 | 7 | 800 | |
| 26*a* | Clapp & Jones. | First. | 1882 | 3 | New boiler 1894. | 8⅛ | 5 | 7 | 800 | 404 |
| 26*b* | Clapp & Jones. | 4th Single. | 1884 | 2 | La France boiler 1898. | 9¼ | 5½ | 6 | 400 | 390 |
| 27*a* | Clapp & Jones. | First. | 1893 | 3 | ..... | 9 | 5⅛ | 8 | 900 | |
| 27*b* | Clapp & Jones. | 4th Single. | 1884 | 2 | La France boiler 1898. | 9¼ | 5⅛ | 6 | 400 | 402 |
| 28 | La France. | Second. | 1886 | 3 | La France boiler 1897. | 7⅛ | 4⅜ | 8 | 700 | |
| 29 | La France. | First. | 1897 | 3 | ..... | 8¼ | 5¼ | 9 | 900 | |
| 30*a* | Metropolitan. | First. | 1905 | 3 | ..... | 9 | 5⅛ | 8 | 900 | |
| 30*b* | Clapp & Jones. | First. | 1890 | 3 | Fox boiler 1902. | 9 | 5⅛ | 8 | 900 | 481 |
| 31*a* | La France. | First. | 1899 | 3 | ..... | 8¾ | 5¼ | 9 | 900 | |
| 31*b* | La France. | Second. | 1893 | 3 | ..... | 8¼ | 4¾ | 8 | 700 | |
| 32 | Clapp & Jones. | Second. | 1883 | 2 | Rebuilt 1896. | 7½ | 4⅝ | 7 | 650 | |
| 33*a* | La France. | First. | 1900 | 3 | Overhauled 1905. | 8¾ | 5¼ | 9 | 900 | 694 |
| 33*b* | Clapp & Jones. | Second. | 1887 | 2 | New boiler 1898. | 7½ | 4⅞ | 7 | 650 | ..... |
| 34 | La France. | First. | 1896 | 3 | ..... | 8¾ | 5¼ | 9 | 900 | 446 |
| 35 | Metropolitan. | Second. | 1905 | 3 | ..... | 8 | 4¾ | 8 | 700 | |
| 36 | Clapp & Jones. | Third. | 1894 | 3 | ..... | 7 | 4⅜ | 7 | 600 | |
| 37 | Metropolitan. | Fourth. | 1898 | 3 | ..... | 6⅛ | 4 | 7 | 500 | 373 |
| 38 | Amoskeag. | Fourth. | 1898 | 2 | ..... | 6⅛ | 3⅞ | 8 | 500 | |
| 39 | La France. | Third. | 1895 | 3 | ..... | 7¼ | 4⅛ | 8 | 600 | |
| 40 | La France. | Third. | 1892 | 3 | ..... | 7¼ | 4⅛ | 8 | 600 | |
| 41 | La France. | Third. | 1894 | 3 | La France boiler repaired 1900. | 7¼ | 4⅛ | 8 | 600 | |
| 42 | Metropolitan. | Fourth. | 1898 | 3 | ..... | 6⅛ | 4 | 7 | 500 | |
| 43 | Clapp & Jones. | 4th Single. | 1881 | 3 | New boiler 1897. | 9¼ | 5½ | 6 | 400 | |
| 44 | Clapp & Jones. | Second. | 1896 | 3 | ..... | 8½ | 5 | 7 | 700 | |
| 45 | Ahrens. | Second. | 1883 | 3 | La France boiler 1893. | 6¾ | 4⅛ | 8 | 650 | 376 |
| 46 | Metropolitan. | Third. | 1901 | 3 | ..... | 7½ | 4½ | 7 | 600 | |
| 47 | Metropolitan. | Second. | 1905 | 3 | ..... | 8 | 4¾ | 8 | 700 | |
| 48 | Clapp & Jones. | 4th Single. | 1883 | 3 | Rebuilt 1898. | 9¼ | 5⅛ | 6 | 400 | |
| 49 | Clapp & Jones. | 4th Single. | 1881 | 2 | New boiler 1897. | 9¼ | 5⅛ | 6 | 400 | |
| 49*c* | Amoskeag. | 2d Single. | 1866 | 2 | La France boiler 1889. | 8 | 4¼ | 12 | 475 | 351 |

TABLE No. 15.—STEAM FIRE ENGINES—(*Continuea*).

| Engine No. | Make. | Size. | Put in Service. | Horses. | Renewals. | Diameter, Inches. | | Stroke, Inches. | Capacity, Gallons per Minute. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Cylinder. | Pump. | | Rated. | At Test. |
| 49*c* | Amoskeag. | 2d Single. | 1866 | 2 | La France boiler 1889. | 8 | 4¾ | 12 | 475 | |
| 49*c* | Amoskeag. | Second. | 1868 | Hand. | La France boiler 1886. | 6⅞ | 4⅛ | 8 | 500 | |
| 49*c* | Nott. | Third. | 1903 | 2 | ..... | 6½ | 4⅜ | 8 | 650 | |
| 49*c* | Ahrens. | Second. | 1883 | 2 | La France boiler 1894. | 6¾ | 4¼ | 8 | 650 | |
| 50 | Metropolitan. | Third. | 1905 | 3 | ..... | 7⅛ | 4½ | 7 | 600 | 573 |
| 52 | Clapp & Jones. | 5th Single. | 1884 | 3 | Rebuilt 1899. | 7½ | 4⅝ | 6 | 300 | |
| 53 | Metropolitan. | Third. | 1900 | 3 | ..... | 7½ | 4½ | 7 | 600 | 563 |
| 54 | La France. | First. | 1897 | 3 | ..... | 8¾ | 5¼ | 9 | 900 | |
| 55 | Metropolitan. | First. | 1899 | 3 | ..... | 9 | 5½ | 8 | 900 | |
| 56 | La France. | Third. | 1900 | 3 | ..... | 7⅜ | 4¼ | 8 | 600 | 505 |
| 58 | La France. | Third. | 1893 | 3 | ..... | 7¼ | 4½ | 8 | 600 | |
| 59 | Clapp & Jones. | Third. | 1894 | 3 | ..... | 7 | 4⅜ | 7 | 600 | 423 |
| 60 | La France. | Third. | 1895 | 3 | ..... | 7¼ | 4⅛ | 8 | 600 | |
| 61 | Clapp & Jones. | 4th Single. | 1881 | 3 | La France boiler 1897. | 9¼ | 5½ | 6 | 400 | |
| 62 | Clapp & Jones. | 4th Single. | 1881 | 3 | La France boiler 1896. | 9¼ | 5½ | 6 | 400 | |
| 65 | La France. | First. | 1898 | 3 | ..... | 8¾ | 5¼ | 9 | 900 | |
| 67 | La France. | Fourth. | 1898 | 2 | ..... | 6⅞ | 4 | 7 | 500 | 462 |
| 68 | La France. | Fourth. | 1898 | 3 | ..... | 6⅞ | 4 | 7 | 500 | |
| 69 | Clapp & Jones. | 5th Single. | 1883 | 3 | Rebuilt 1899. | 7½ | 4⅝ | 6 | 300 | 233 |
| 70 | Clapp & Jones. | 4th Single. | 1884 | 2 | Rebuilt 1899. | 9¼ | 5½ | 6 | 400 | |
| 70*c* | Amoskeag. | Second. | 1871 | 2 | C. & J. boiler 1883. | 6⅞ | 4⅛ | 8 | 500 | |
| 71 | Amoskeag. | Fourth. | 1899 | 3 | ..... | 6⅛ | 3⅞ | 8 | 500 | 269 |
| 72 | La France. | First. | 1900 | 3 | ..... | 8¾ | 5¼ | 9 | 900 | |
| 73 | Clapp & Jones. | 4th Single. | 1881 | 3 | La France boiler 1896. | 9¼ | 5½ | 6 | 400 | |
| 74 | Metropolitan. | Third. | 1901 | 3 | ..... | 7½ | 4½ | 7 | 600 | |
| 75 | Metropolitan. | Fourth. | 1901 | 3 | ..... | 6½ | 4 | 7 | 500 | |
| 76 | Metropolitan. | Second. | 1904 | 3 | ..... | 8 | 4¾ | 8 | 700 | 690 |
| 76*b* | Metropolitan. | Second. | 1904 | 3 | ..... | 8 | 4¾ | 8 | 700 | |
| 79 | Metropolitan. | Fourth. | 1905 | 3 | ..... | 6⅛ | 4 | 7 | 500 | |
| 80*a* | La France. | Third. | 1889 | 3 | ..... | 8¾ | 4⅞ | 6 | 600 | 446 |
| 80*b* | La France. | Third. | 1890 | 3 | Repaired 1898. | 8¼ | 4⅞ | 6 | 600 | |
| 81 | Clapp & Jones. | 4th Single. | 1883 | 3 | La France 1898. | 9¼ | 5½ | 6 | 400 | |
| 82 | Amoskeag. | Third. | 1891 | 3 | ..... | 8½ | 4⅞ | 6 | 550 | |
| **RESERVE ENGINES.** | | | | | | | | | | |
| 1st Battalion | La France. | Third. | 1891 | ..... | ..... | 8½ | 4⅞ | 6 | 600 | |
| 1st Battalion. | Clapp & Jones. | Second. | 1883 | ..... | ..... | 7⅛ | 4⅝ | 7 | 650 | 471 |
| 2d Battalion. | Nott. | First. | 1903 | ..... | Repaired 1905. | 10 | 5⅝ | 8 | 1,000 | |
| 2d Battalion. | Clapp & Jones. | First. | 1893 | ..... | ..... | 9 | 5½ | 8 | 900 | |
| 4th Battalion. | Clapp & Jones. | First. | 1882 | ..... | La France boiler 1895. | 8⅛ | 5 | 7 | 800 | |
| 4th Battalion. | La France. | Third. | 1890 | ..... | ..... | 8½ | 4⅞ | 6 | 600 | |
| 5th Battalion. | Clapp & Jones. | First. | 1882 | ..... | La France boiler 1894. | 8⅛ | 5 | 7 | 800 | |
| 5th Battalion. | Clapp & Jones. | Second. | 1886 | ..... | La France boiler 1893. | 7½ | 4⅞ | 7 | 650 | |
| 7th Battalion. | Nott. | Third. | 1903 | ..... | ..... | 6½ | 4⅝ | 8 | 650 | 375 |
| 7th Battalion. | Clapp & Jones. | First. | 1880 | ..... | New boiler 1894. | 8 | 4⅞ | 7 | 800 | |
| 9th Battalion. | Clapp & Jones. | Second. | 1885 | ..... | C. & J. boiler 1896. | 7½ | 4⅝ | 7 | 650 | |
| 10th Battalion. | Amoskeag. | Third. | 1895 | ..... | ..... | 6½ | 4 | 8 | 600 | |
| 11th Battalion. | La France. | Third. | 1889 | ..... | ..... | 8¼ | 4⅞ | 6 | 600 | |
| 11th Battalion. | La France. | Third. | 1891 | ..... | ..... | 8¼ | 4⅞ | 6 | 600 | |
| 12th Battalion. | La France. | Third. | 1889 | ..... | ..... | 8¼ | 4⅞ | 6 | 600 | |
| 13th Battalion. | Amoskeag. | Second. | 1871 | ..... | ..... | 6⅞ | 4½ | 8 | 650 | 429 |
| 15th Battalion. | Amoskeag. | 3d Single. | 1877 | ..... | La France boiler 1888. | 7⅝ | 4¼ | 9 | 400 | 353 |
| 17th Battalion. | Amoskeag. | Third. | 1895 | ..... | ..... | 6⅛ | 4 | 8 | 600 | |
| 17th Battalion. | Amoskeag. | Second. | 1875 | ..... | La France boiler 1889. | 6⅞ | 4½ | 8 | 650 | 429 |
| 18th Battalion. | Ahrens. | 3d Single. | 1883 | ..... | Latta boiler 1899. | 8 | 5 | 7 | 400 | 351 |
| Old Eng. 12. | La France. | First. | 1900 | ..... | ..... | 8¾ | 5⅛ | 9 | 900 | |
| Old Eng. 16. | Clapp & Jones. | First. | 1891 | ..... | ..... | 9 | 5½ | 8 | 900 | |
| Old Eng. 19. | Amoskeag. | Second. | 1871 | ..... | ..... | 6⅞ | 4⅕ | 8 | 500 | |
| Old Eng. 20. | Amoskeag. | 2d Single. | 1866 | ..... | ..... | 8 | 4¾ | 12 | 475 | |
| Old Eng. 25. | Clapp & Jones. | First. | 1891 | ..... | New tubes 1892. | 9 | 5½ | 8 | 900 | |

*a*. Attached to first section of double company. *b*. Attached to second section of double company. *c*. Extra engine.
* Water supply insufficient.

**EQUIPMENT.—Summary of Apparatus.—**

| | In Service. | In Reserve. |
|---|---|---|
| First size steam engines | 30 | 8 |
| Second size steam engines | 19 | 7 |
| Third size steam engines | 19 | 10 |
| Fourth size steam engines | 23 | 0 |
| Fifth size steam engines | 2 | 0 |
| Total steam fire engines | 93 | 25 |
| Fire-boats | 5 | 2 (Brooklyn) |
| Hose wagons, combination type | 4 | 0 |
| " " plain | 86 | 7 |
| " " reels | 9 | 9 |
| Total hose wagons and reels | 99 | 16 |
| Ladder trucks, aerial | 19 | 1 |
| " " ordinary | 30 | 4 |
| Total ladder trucks | 49 | 5 |
| Chemical engines | 5 | 2 |
| Searchlight engines | 2 | 0 |
| Water towers | 4 | 1 |
| Chiefs' wagons | 33 | 15 |
| Wagons for fuel or supply | 38 | * |
| Horses | 605 | 30 |

| | Serviceable. | Unserviceable. |
|---|---|---|
| Hose— 1-inch | 4,800 ft. | |
| " —1½-inch | 40,300 ft. | 200 ft. |
| " —2½-inch | 196,600 ft. | 3,600 ft. |
| " — 3-inch | 50,350 ft. | 950 ft. |
| " —3½-inch | 2,400 ft. | |
| " —3¾-inch taper | 890 ft. | |
| " —3¾-inch | 15,200 ft. | 150 ft. |
| " — 4-inch | 1,145 ft. | |
| " — 5-inch | 450 ft. | |
| " — 6-inch | 350 ft. | |

| | In Service. | In Reserve. |
|---|---|---|
| Total length of ladders | 15,920 ft. | |
| Short ladders on wagons, etc. | 165 | |
| Deluge sets | 1 | |
| Siamese connections | 117 | |
| Turret nozzles on apparatus | 5 † | 1 |
| Ladder pipes | 19 | 1 |
| Portable extinguishers | 91 | 112 |
| Special couplings for other cities | 0 | 0 |

* Reserve hose wagons sometimes used for fuel wagons.
† Does not include 18 turret nozzles on the five fire-boats.

**Steam Fire Engines.**—In service, 93; in reserve, 25. See Table No. 15. The 93 engines in service include six which are stationed on islands in the East River with no men in quarters. The engines are all of standard makes and are of all ages, 29 of those in service being more than 20 years old; 21 of the latter have been rebuilt or have received new boilers within the last 10 years. The list of engines includes none of either extra first or double extra first sizes.

There are 30 engines of the first size in service, including three old engines which should now be rated as second size. Twenty-five engines of those in service are smaller than third size and are rated at capacities less than sufficient to supply two ordinary fire streams.

The down town engines are, on the whole, in poor condition, due to the hard usage they receive and to the fact that less experienced engineers are assigned to the down-town companies. The policy of the department, partly dictated by the overcrowded condition of the repair shops, also is to avoid repairs until the necessity for them becomes urgent. The engines north of Fifty-ninth street, both in Manhattan and The Bronx, are generally in fair to good condition. While engines are tested before acceptance by the chief of construction and repair, these tests are roughly carried out and do not give accurate indications of either the efficiency or the capacity of the engines. Engines carry suctions both 4½ inch and 2½ inch in diameter, and are well equipped with minor fittings, including automatic relief valve, compound gages, fresh water connections, suction reducers and tools. Many of them carry short lengths of 4½-inch hose for coupling two engines in tandem to a single outlet hydrant. Sixteen of the newer engines are equipped with rubber tires.

Many of the older fourth size engines are stationed in double companies to replace first size engines when the latter are absent from quarters. The eight engines which are 30 or more years old are assigned to reserve duty, most of them being stationed on the islands.

**Engine Tests.**—Thirty-two land engines were tested in June and July, 1905, by engineers of the National Board to ascertain their condition and capacity, and the ability of the men handling them. These included 25 of the engines in regular service, and 7 which are used as spare engines.

*Engine 2.*—First size Metropolitan; 8 years in service. Rated capacity 900 gallons per minute; at test 776 gallons against 105 pounds net water pressure. Steam poorly maintained, but speed fair. Boiler tubes leak; engine slightly out of adjustment. Slip exceeded 12 per cent. Regular stoker absent. Engine needs overhauling.

*Engine 5, First Section.*—First size Clapp & Jones; 1 year in service. Rated capacity 900 gallons per minute; at test 870 gallons against 104 pounds net water pressure. Steam well maintained; speed good. Slip about 7 per cent., considerable. Engineer not expert.

*Engine 11.*—Second size La France; pumps overhauled in 1905; 12 years in service. Rated capacity 700 gallons per minute; at test 389 gallons against 92 pounds net water pressure. Steam supply after nine minutes insufficient to continue test. Crank pin heated in three minutes in spite of moderate speed. Slip of 36 per cent. indicates seriously defective condition of pump. Condition as a whole unserviceable.

*Engine 13, First Section.*—First size Metropolitan; 5 years in service. Rated capacity 900 gallons per minute; at test 525 gallons against 73 pounds net water pressure. Steam poorly maintained. Test discontinued owing

to lack of water at hydrant. Suction connections defective.

*Engine 16, First Section.*—Second size La France; 13 years in service. Rated capacity 700 gallons per minute; at test 421 gallons against 89 pounds net water pressure. Great difficulty in maintaining water pressure; steam poor; speed low. Slip over 12 per cent., high. Engine needs overhauling and probably new boiler.

*Engine 18, First Section.*—First size Nott; 2 years in service. Rated capacity 1,000 gallons per minute; at test 619 gallons against 92 pounds net water pressure. Steaming capacity hampered by old leak in boiler, which after 10 minutes of test extinguished fire, thereby putting engine out of service. Slip 11 per cent., high. Boiler needs repairs.

*Engine 18, Second Section.*—Fourth size Clapp & Jones; single pump; 21 years in service. Rated capacity 400 gallons per minute; at test 274 gallons against 73 pounds net water pressure. Steam poorly maintained; speed variable. Slip 7 per cent.; considerable. Several leaks in steam and water connections. Steam valve defective.

*Engine 26, First Section.*—First size Clapp & Jones; 23 years in service; rebuilt with new boiler in 1895. Rated capacity 800 gallons per minute; at test 404 gallons against 52 pounds net water pressure. Steam poorly maintained; speed low. Slip of 23 per cent. indicates seriously defective condition. Valves poor; steam connection leaky; stoking poor. (This engine is reported to have broken down seven times during the last winter.)

*Engine 26, Second Section.*—Fourth size Clapp & Jones; single pump; new boiler 1898; 21 years in service. Rated capacity 400 gallons per minute; at test 390 gallons against 116 pounds net water pressure. Steam well maintained; speed excellent. Slip 8.5 per cent.; rather high. Slight leaks in air chamber and other water connections. Engine, as a whole, in good condition and well handled.

*Engine 27, Second Section.*—Fourth size Clapp & Jones single; new boiler 1898; 21 years in service. Rated capacity 400 gallons per minute; at test 402 gallons against 103 pounds net water pressure. Steam supply variable and good on the whole; speed excellent. Slip moderate; slight leakage in feed water connection. Pump stuffing blew out. Handling not careful.

*Engine 30, Second Section.*—First size Clapp & Jones; 15 years' service; new boiler in 1902. Rated capacity 900 gallons per minute; at test 481 gallons against 78 pounds net water pressure. Unable to maintain proper steam pressure, owing to accidental loss of pin in the exhaust connection; steam valves in poor adjustment. Slip 7.6 per cent.; considerable; stoker inexperienced. Engine needs overhauling.

*Engine 33, First Section.*—First size La France; 5 years in service; overhauled in 1905. Rated capacity 900 gallons per minute; at test 694 gallons against 97 pounds net water pressure. Steam poorly maintained; speed moderate. Slip of 20 per cent. indicates defective condition of pump valves. Stuffing boxes, gaskets and unions poorly adjusted. Condition of engine, as a whole, poor, indicates defective maintenance.

*Engine 33, Second Section.*—Second size Clapp & Jones; 18 years in service. Rated capacity 650 gallons per minute; after 8 minutes of test, engine had to be shut down and fires drawn, owing to the failure of feed pump. Leaks had previously developed at several places in water connections. Slip of 20 per cent. indicates pump valves out of order. Maintenance of engine poor.

*Engine 34.*—First size La France; 9 years in service. Rated capacity 900 gallons per minute; at test 446 gallons against 96 pounds net water pressure. Steam supply insufficient for even moderate speed. Poor boiler; feed pump bracket loose; feed pump rod broke; several leaks in water connections; adjustment poor. Stoking good.

*Engine 37.*—Fourth size Metropolitan; 7 years in service. Rated capacity 500 gallons per minute; at test 373 gallons against 85 pounds net water pressure. Steam pressure fairly well maintained, but speed rather low. Slip, 19 per cent., showed defective condition of pumps. Well run and fired by one engineer at a time.

*Engine 45.*—Second size Ahrens; 22 years in service; new boiler in 1893. Rated capacity 650 gallons per minute; at test 376 gallons against 92 pounds net water pressure. Steam supply insufficient; speed low. Slip 10 per cent.; rather high. Eccentric strap worked loose; discharge gate needed attention. Run and fired by one engineer.

*Engine 49.*—Second engine, Blackwell's Island. Second size Amoskeag, single; 39 years in service; new boiler in 1889. Rated capacity 475 gallons per minute; at test 351 gallons against 92 pounds net water pressure. Steam supply fair, limited by low setting of safety valve; speed low. Slip 5.7 per cent.; moderate. Engine run and fired by one man; handling fair.

*Engine 50.*—Third size Metropolitan; new engine. Rated capacity 600 gallons per minute; at test 573 gallons against 102 pounds net water pressure. Boiler foamed considerably; steam supply sufficient; speed good. Slip 4 per cent.; normal. Engine in good condition; handling uneven. Regular stoker absent.

*Engine 53.*—Third size Metropolitan; 5 years in service. Rated capacity 600 gallons per minute; at test 563 gallons against 109 pounds net water pressure. Steam supply good; speed good. Slip of 9 per cent. considerable. Three oil cups dropped off; hand-relief valve out of order.

*Engine 56.*—Third size La France; 5 years in service. Rated capacity 600 gallons per minute; at test 505 gallons against 109 pounds net water pressure. Steam supply well maintained; speed generally good. Slip 7.8 per cent.; rather high. Crank pin heated slightly. Regular engineer absent; well handled.

*Engine 59.*—Third size Clapp & Jones; 11 years in service. Rated capacity 600 gallons per minute; at test 423 gallons against 94 pounds net water pressure. Steam supply insufficient for proper speed. Slip 6.6 per cent.; slightly above normal; engine in fair condition. Stoker needs instruction.

*Engine 67.*—Fourth size La France; 7 years in service. Rated capacity 500 gallons per minute; at test 462 gallons against 121 pounds net water pressure. Steam well maintained; speed good. Slip 2.6 per cent.; normal. Engine in good condition; well handled.

*Engine 69.*—Fifth size Clapp & Jones; single pump; 23 years in service; new boiler in 1899. Rated capacity 300 gallons per minute; at test 233 gallons against 101 pounds net water pressure. Steam handicapped by low safety valve; speed moderate. Slip 6.5 per cent.; slightly above normal; leaks in water connection.

*Engine 71.*—Fourth size Amoskeag; 6 years in service. Rated capacity 500 gallons per minute; at test 269 gallons against 95 pounds net water pressure. Steam supply insufficient and poorly maintained; speed very low. Slip 3.5 per cent.; normal. Steam chest packing leaks badly; stoking very poor.

*Engine 76, First Section.*—Second size Metropolitan; 1 year in service. Rated capacity 700 gallons per minute; at test 690 gallons against 93 pounds net water pressure. Steam supply fair; speed excellent. Slip 6.4 per cent.; slightly above normal; engine ran well and steadily. Good engineer; stoker careless.

*Engine 80, First Section.*—Third size La France; 16 years in service. Rated capacity 600 gallons per minute; at test 446 gallons against 91 pounds net water pressure. Steam supply insufficient for proper speed. Slip 3.2 per cent.; normal; stuffing box not tight.

*Spare Engine, First Battalion.*—(In service as engine No. 27.) Second size Clapp & Jones; 22 years in service. Rated capacity 650 gallons per minute; at test 471 gallons against 105 pounds net water pressure. Steam supply sufficient; fair speed. Slip 19 per cent., indicates defective condition of pump; slight leaks at discharge gate and steam glands. Well fired.

*Spare Engine, Seventh Battalion.*—Third size Nott; 2 years in service. Rated capacity 650 gallons per minute; at test 375 gallons against 74 pounds net water pressure. Unable to maintain proper steam pressure; boiler foamed considerably; speed low. Slip 15.4 per cent.; high; handling fair.

*Spare Engine, Thirteenth Battalion.*—Second size Amoskeag; 34 years in service. Rated capacity 650 gallons per minute; at test 429 gallons against 106 pounds net water pressure. Steam fairly well maintained; speed low. Slip 16 per cent.; excessive. Steam and water packings not tight. Well run and fired by single engineer.

*Spare Engine, Fifteenth Battalion.*—Third size Amoskeag, single; 28 years in service; new boiler in 1888. Rated capacity 400 gallons per minute; at test 353 gallons against 83 pounds net water pressure. Steam well maintained; speed low. Slip 11 per cent.; considerable. Leaks in packing and elsewhere. Well handled.

*Spare Engine, Seventeenth Battalion.*—Second size Amoskeag; 30 years in service; new boiler in 1889. Rated capacity 650 gallons per minute; at test 429 gallons against 89 pounds net water pressure. Steam supply variable; speed rather low. Slip 18.7 per cent.; excessive; shows defects in pump. Leaks in stuffing box, feed pump and air chamber. Well run and fired by single engineer. Poor steamer.

*Spare Engine, Eighteenth Battalion.*—Third size Ahrens, single; 22 years in service. Rated capacity 400 gallons per minute; at test 351 gallons against 116 pounds net water pressure. Test stopped after eight minutes' capacity test, owing to breaking of oil cup, a result of previous unworkmanlike repairs. Speed excellent. Slip 6.4 per cent.; moderate.

*General.*—As shown in Table No. 16 the average capacity of the seven first size engines tested was 613 gallons, or 287 gallons less than their rated capacity, and nearly 100 gallons less than the rated capacity of modern engines of the second size. But two of these engines discharged more than 700 gallons per minute, and three failed to reach 500 gallons per minute. These figures for first size engines are almost unprecedented. The test of engine 13a is not included in Table No. 16.

The eight second size engines tested, as shown in Table No. 16, discharged on an average slightly less than the eight third size engines, although rated at about 100 gallons larger capacity. Only one of the second size discharged as much as 500 gallons per minute. Modern engines of this class in good condition often show a capacity at tests of 750 gallons per minute, sometimes exceeding 800 gallons.

The showing of the third size engines was considerably better than those of larger size, four of them exceeding 500 gallons per minute, the average for the eight reaching 80 per cent. of their rated capacity.

The fourth size engines also averaged 80 per cent. of their rating, but these engines are too small for modern service, as they are unable to supply two effective fire streams. The same criticism applies to several of the older third size engines.

The average slip developed in the pumps of the first and second size engines was excessive, exceeding 14 per cent. in both of these classes. Slip exceeding 7 per cent. is high and warrants a close inspection of pumps; this figure was exceeded in 18 of the engines tested, which indicates that the supervision exercised over the apparatus is extremely lax. In six engines the slip approached or exceeded 20 per cent., sufficient to have been observable to an engineer of good ability. The handling of the engine in many cases showed lack of proper instruction, the efficiency of the men as a whole being poor. There were, however, many notable exceptions.

The tests of six engines could not be carried to completion for the following reasons:

Engine 11.—Unable to make sufficient steam.
Engine 13.—Water supply from hydrant inadequate.
Engine 18a.—Leak in boiler extinguished fire.
Engine 18b.—Rocker valve loosened and slipped.
Engine 33b.—Feed pump failed to work.
Spare engine, 18th battalion.—Oil cup broke off.

TABLE NO. 16.—RESULTS OF ENGINE TESTS.

| Size of Engines. | Number Tested. | Capacity of Engines. | | | Slip of Pumps. Per Cent. | |
|---|---|---|---|---|---|---|
| | | Gallons per Minute. | | Per Cent. of Rated Capacity Obtained. | | |
| | | Rated. | Obtained at Test. | | Normal | At Test. |
| First .... | 7 | 900 | 613 | 68.2 | 3 to 5 | 14.5 |
| Second... | 8 | 647 | 445 | 68.8 | " | 14.8 |
| Third.... | 8 | 556 | 449 | 80.7 | " | 8.0 |
| Fourth... | 6 | 450 | 362 | 80.4 | " | 7.8 |
| Fifth..... | 1 | 300 | 252 | 84.0 | " | 6.5 |
| Average.. | ..... | 631 | 462 | 73.2 | 3 to 5 | 11.2 |

**Fire Boats.**—In service, 5; in reserve, 2 (at Brooklyn).

Engine 51, *Zophar Mills.* Built 1882; two double pumps of Clapp & Jones type, steam cylinder 17 inches, pump plunger 9 inches; stroke 11 inches. Rated capacity, 1,500 gallons per unit; total, 3,000 gallons per minute. Two boilers of locomotive type; limited to 65 pounds steam pressure. Iron hull; built by Pusey & Jones; 120 feet over all; 25 feet beam. Equipped with three turret nozzles (diameter of usual tip, 2 inches); two hose reels, each carrying 1,250 feet of 3½-inch hose; 300 feet of 2½-inch hose; 100 feet each of 4-inch, 5-inch, and 6-inch hose and searchlight. The supply of nozzles, siamese connections, burst hose jackets, reducers and enlargers fairly complete; 10 outlets for attaching lines of hose. Total crew, 29 men.

Engine 57, *The New Yorker.* Built 1890; two double Clapp & Jones pumps; and two double La France pumps, each with 17-inch cylinder, 10-inch pump plunger, 11-inch stroke. Rated capacity of each pump, 3,250 gallons per minute; total capacity, 13,000 gallons; capacity estimated from boiler dimensions, approximately 9,000 gallons per minute. Two Scotch boilers; nominal 800 H. P. Steel hull, 125.5 feet long, 26 feet beam. Built by Julius Johnson. Equipped with six turret nozzles and 18 hose outlets. Carries 2,700 feet of 3½-inch hose on two reels; also 550 feet of 2½ inch; 50 feet of 4 inch; 150 feet of 6 inch, and 400 feet of 1½ inch. Provided with searchlight and full equipment of nozzles, siamese connections, nozzle holders and minor appliances. Alterations completed in October, 1905, increased the speed to approximately 14 miles per hour. Total crew, 34 men.

Engine 66, *William L. Strong.*—Built 1898. Two double pumps with 17-inch cylinders, 10-inch pump plunger, 11-inch stroke. Nominal capacity of each pump, 3,250 gallons; total capacity, 6,500 gallons; capacity estimated from boiler dimensions about 4,500 gallons per minute. Built by Dialogue & Sons; 111 feet long; 24 feet beam. Two Scotch boilers, about 340 H. P. Equipped with three turret nozzles having 1⅜ inch, 1½ inch and 2½ inch nozzles and 1,900 feet of 3½-inch hose on reel or in bin; 1,850 feet of smaller hose, and 800 feet of 4 inch, 5 inch or 6 inch hose is also carried as well as 12 hose outlets. The boat is provided with the usual equipment of searchlight, nozzles, holders and minor appliances. Total crew, 27 men.

Engine 77, *Abram S. Hewitt.*—Built 1903; equipped with two La France double pumps with 17-inch cylinders, 10-inch pump plungers, 11-inch stroke. Rated capacity of each pump, 3,500 gallons. Also has a first size fire engine pump with 9-inch cylinder, 5½-inch pump and 8-inch stroke. Rated capacity, 900 gallons. Total rated capacity, 7,900 gallons per minute; total capacity estimated from boiler and engine data, about 7,000 gallons per minute. Two Scotch boilers, 10 feet 9 inches diameter, by 11 feet 9 inches in length. Steel hull built by the New York Shipbuilding Company;

length 117 feet over all; beam 24 feet 3 inches. The boat is equipped with three turret nozzles and 12 hose outlets. Hose carried includes 1,650 feet of 3½ inch, 750 feet of 3 inch, 480 feet of 1½ inch. Searchlight and fair equipment of minor appliances. Total crew, 25 men. This boat is regularly stationed at the foot of Main street, Brooklyn, but answers many alarms on the Manhattan side.

Engine 78, *George B. McClellan.*—Built 1904. Similar to Engine 77. Two double La France pumps, 17-inch cylinders, 10-inch pump plungers, 11-inch stroke. Rated capacity of each, 3,250 gallons; total rated capacity, 6,500 gallons. Two Scotch boilers like those on Engine 77. Steel hull built by the New York Shipbuilding Co. The boat is equipped with three turret nozzles and 20 hose outlets. One thousand feet of 3½-inch hose is carried on reel in addition to 1,550 feet of smaller hose. The usual equipment of nozzles and minor appliances and searchlight is carried. Gross tonnage, 256 tons. Total crew, 34 men.

*Fire Boat Tests.*—Permission to make tests of the fire boats was refused. The estimated capacity of the pumps is figured on a basis of 150 pounds water pressure. It has been reported that the pumps are usually unable to run continuously at their full rated capacity, but authentic data on this point were unobtainable.

**Hose Wagons.**—In service, 99; in reserve, 16. See Table No. 14. Of the 99 wagons in service, four are equipped with chemical tanks, 86 are plain wagons and the remaining 9 are old fashioned reels with either two or four wheels. The latter are assigned almost exclusively to the islands in the East River. The wagons are all of standard make and are generally in good condition. They carry from 1,000 to 1,200 feet of hose—the down town wagons having both 2½ inch and 3 inch—and those in residence districts carry 250 to 500 feet of 1½-inch hose additional. The equipment of each wagon is fairly full, but does not include portable extinguishers or modern appliances for handling powerful streams.

Three hose wagons are used as tenders for the fire boats. These are stationed with engine companies 19 and 53 and ladder company 10. Each carries either 1,000 feet or 1,250 feet of 3½-inch hose and is driven by a man detailed from the company in quarters.

**Ladder Trucks.**—In service, 49; in reserve, 5. See Table No. 14. Nineteen of the trucks in service are of the aerial type, having either Hayes, Babcock, Seagrave or Dederick hoist. Three modern quick-raising aerials of the spring-balanced and pneumatic types have recently been put in service. Several of the smaller trucks of ordinary roller frame type were built in the repair shop; the others are of standard modern makes. Most of them are in good repair, although the down-town trucks are subjected to hard usage. Each aerial truck carries in addition to its attached ladder, a 50 foot extension and 10 to 14 shorter ladders, including three or four scaling ladders 12 to 18 feet in length.

**Chemical Engines.**—In service, 5; in reserve, 2. See Table No. 14. The chemical engine attached to engine company 79 is of the usual type, is drawn by three horses, and is equipped with two 50-gallon tanks. Two reserve chemicals are of a similar type but with larger tanks. The four chemical engines assigned to engine company 49 are all drawn by hand. The two larger engines are over 30 years old.

**Search Light Engines.**—Two search light engines built by the La France Fire Engine Company in 1900 and 1901 are in service with engine company 20 and ladder company 4, each of which companies details two men to handle the search light. Current is produced by a 5 K. W. Bullock marine type multipolar generator driven by a steam engine and is utilized in two 16-inch search lights on No. 1 and two 18-inch search lights on No. 2. These engines are in service and respond to alarms between sunset and sunrise.

**Water Towers.**—In service, 4; in reserve, 1. See Table No. 14. All are of the Hale type with heights from 58 to 64 feet. Each has one turret nozzle on deck in addition to the water tower, and uses nozzles varying in size from 1¾ inch to 2 inch. Six 3-inch hose inlets for the main tower and four similar inlets for the turret nozzle admit the water. They are raised by water power. Each is drawn by three horses and is manned either by three or four men from the company with which it is stationed.

**Chiefs' Wagons.**—In service, 33; in reserve, 15. Each chief officer is provided with a rubber tired buggy. Additional buggies are assigned to the use of the two chaplains and to the fire commissioner. A 40 horse-power automobile is used by the chief of department, and a smaller one by the acting chief.

**Fuel Wagons, etc.**—In service, 38. Twenty-five fuel wagons are stationed in the different battalions loaded with from one to two tons of coal in cans. They are well built and kept in good order. Other wagons are provided for the fire alarm telegraph branch and for the repair shops, as well as supply wagons and powder wagons.

**Hose.**—

| | AMOUNT SERVICEABLE. |
|---|---|
| 2½-inch | 196,600 ft. |
| 3-inch | 50,350 ft. |
| 3½-inch | 15,200 ft. |
| Larger sizes | 2,000 ft. |
| Chemical hose | 4,550 ft. |
| 1½-inch | 39,600 ft. |

The 2½-inch and the 3-inch hose are the usual sizes for use with the engines, a quantity of each of these sizes being carried on the wagons attached to the down town engine companies. About half of the 2½-inch hose is cotton rubber lined, the other half being rubber. It includes 28 different brands made by 13 or more makers; 137,400 feet, or about 70 per cent., have been purchased within the last seven years. About one-third of the 3-inch hose is cotton rubber lined, the other two-thirds being rubber. It includes over 12 different brands from eight makers, and 24,850 feet or slightly less than 50 per cent. have been purchased within the last seven years.

The combined amount of serviceable 2½-inch and 3-inch hose is sufficient to provide about 2,600 feet for each of the hose wagons regularly in service, exclusive of the reels on the islands and the hose on the fire boats.

The 3½-inch hose is intended primarily for the use of the fire boats; about four-fifths of it is rubber hose; 11,850 feet, or over 75 per cent., have been purchased in the last seven years; six makers are represented. A small amount (2,400 feet) of 3¼-inch hose is still in service; this is fitted with 3½-inch couplings. About two-thirds of it is rubber and all is over seven years old.

The 4-inch, 5-inch and 6-inch hose is intended to be attached to the fire boats when long lines are called for; the amount of this hose on hand is slight and none has been purchased recently. Several companies are provided with 25-foot sections of rubber hose tapering from 3¼-inch to 2½-inch for use between siamese connections and play pipes.

The 1½-inch hose is carried on most of the hose wagons in residential districts, on some of the ladder trucks, as well as on three of the fire boats. It is generally used to extend lines of 2½-inch hose; four-fifths of it is rubber, and 25,800 feet, or 65 per cent., have been purchased within the last seven years.

All hose is purchased under specifications, the latest set being drawn up in June, 1905. Particular attention is paid to the strength of the fabric and elasticity of the rubber. Hose must withstand 300 pounds pressure when new; sample lengths are tested by the department. All 2½-inch and 3-inch hose which has seen more than one year's service is tested yearly at a pressure of 150 pounds. After use it is cleaned off with water and brooms and dried in vertical towers, being supported by the lugs on the female couplings. It is shifted on the wagons every two weeks, or oftener if used. It is continued in service until it bursts. Some sections in the department are nearly 20 years old. The price paid for new hose and the brands usually purchased indicate that most of the hose is of good quality.

**Couplings.**—All couplings are of the usual screw type and have the following dimensions:

DIMENSIONS OF COUPLINGS.

| Connection. | Nominal Size, Inches. | Outside Diameter of Male Thread, Inches. | Threads per Inch. |
|---|---|---|---|
| Hose (Chemical).... | 2¾ | 1 1/16 | 11 |
| Hose..... | 1½ | 2 3/32 | 8 |
| Hose..... ..... | 2½ | 3 | 8 |
| Hose..... | 3 | 3 5/8 | 8 |
| Hose..... | 3½ | 4 1/16 | 8 |
| Hose..... ..... | 4 | 4 9/16 | 8 |
| Hose..... | 6 | 7 3/32 | 4 |
| Hydrant outlets..... | 2½ / 2½ | 3 | 8 |
| Hydrant outlets and engine suctions.... | 4½ | 5 1/16 | 4 |
| National Standard... | 2½ | 3 1/16 | 7½ |
| National Standard... | 4½ | 5¼ | 4 |

None of the 3-inch hose is provided with 2½-inch couplings. All companies using this size of hose carry special reducers and increasers for connecting 2½-inch and 3-inch couplings; 3¼-inch and 3½-inch hose have 3½-inch couplings; 5-inch and 6-inch hose have 6-inch couplings. The 2½-inch couplings could be brought into conformity with the National Standard dimensions by replacing the female couplings. The 4½-inch connections are interchangeable with the National Standard. No reducers are provided for engines from neighboring cities, as the 2½-inch couplings in use in all parts of Greater New York and in most of the New Jersey cities are uniform with those in Manhattan.

**Minor Equipment.**—Companies are well and uniformly equipped. In addition to 2½-inch and 3-inch hose, hose wagons carry axes, hooks, generally two scaling ladders, with life belts, two Callahan shut-off nozzles, with various tips, generally 1⅛ inch to 1¼ inch in diameter, and from three to five plain nozzles, 1 inch to 1½ inch in diameter; hose jackets, hose clamps, door openers, cellar pipes, fire escapes, life nets, window breakers, roof cutter, hose roller, ropes, reducers, siamese connections, saws and augers also form part of the regular hose wagon equipment. The hose wagons in tenement and residence districts carry from 300 to 500 feet of 1½-inch hose with reducers and shut-off nozzles. Neither chemical extinguishers nor portable pumps are carried on any hose wagon, although each company keeps one or more of such appliances in quarters. The siamese connection carried lacks some of the advantages of a deluge set. A turret nozzle forms part of the equipment of hose wagon 58.

Ladder trucks usually carry 8 straight, 3 ex-

tension and 4 scaling ladders; two 3-gallon chemical extinguishers; 50 feet of 3½-inch hose with ladder nozzle; axes; long and short ceiling hooks, etc. The rest of the equipment includes life belts, life net, fire escape, door openers, picks, shovels, forks, buckets, bale hooks, lock breakers, window smashers, tin cutter, wire cutter, rubber gloves, rope in different sizes, rams, saws, augers, rope guns, sledge hammers, mauls, chipping hammers, etc. Cellar pipes and sub-cellar pipes, including revolving nozzles attached to 8-foot lengths of 2½-inch hose are provided, as well as siamese connections, hose rollers, street pipes, nozzles and holders. The down-town trucks usually carry in addition a special cellar pipe, surgical kit, 4-way siamese and roof cutters. The Bronx trucks usually carry less ladders and an equipment of large hose, and 200 feet to 400 feet of 1½-inch hose with shut-off nozzles and reducers. A type of compressed air smoke mask is in service, but is reported to be unsatisfactory. Practically all new apparatus and apparatus rebuilt since 1899 has rubber tires.

**Horses.**—In service, 605; in reserve, 30. The 30 reserve horses are kept on hand to replace those in service. Horses are exercised daily and appear to be in good condition. When sick or injured they are cared for at the department hospital and training stables on West Ninety-ninth street, where stalls are provided for 30 sick or "green" horses. The hospital and the care of all horses is under the charge of a veterinary surgeon, Battalion Chief Shea; he is assisted by 17 subordinates. Every heavy piece of apparatus is drawn by three horses. Some of the horses appear to be old for efficient service.

**Harness.**—All harness is of the modern swinging type and in good condition. It is repaired and in part made by the harness makers at the department repair shops.

**Houses.**—Occupied by fire companies, 106. As a whole, the buildings of the department are well kept, convenient and comfortable; 45 have been built or rebuilt in the last seven years and are in good condition. Twelve houses are of wooden construction, including three sheds on wharves occupied by the fire boat companies. Ten or twelve of the older buildings are in poor condition, those occupied by ladder 1 and ladder 17 being particularly bad. Several of the older houses are crowded, especially those occupied by engine companies 63, 64 and ladder company 10. New quarters are being provided for ladder companies 1 and 17. All but two or three of the engine houses have towers for drying hose, most of which are fireproof or iron lined. Engine heaters in every engine house keep constant pressure on the engine boilers. The horses are released and lights lighted by trips at the watch desk. Automatic switches are provided in 11 of the houses, 4 of these switches automatically turning on and later extinguishing the electric lights. Apparatus is easily accessible in quarters, but in some cases difficulty is met in getting apparatus out into narrow and crowded streets. Such conditions are found in the quarters of ladder companies 10 and 18 and engine 12. Fire department buildings are generally not seriously exposed.

**Repair Shops.**—Repairs to apparatus are made at the fire department repair shop, 132 West Third street. The force is under the supervision of Chief of Construction and Repair Leonard, who is responsible for the condition of all apparatus. Each engineer and company officer is also held responsible. Defects in apparatus are reported to the repair shop. The building is old, in poor condition, and overcrowded so that when engines need rebuilding or the attachment of new boilers they are usually sent to the manufacturers' shops for this work. The force at the repair shop includes machinists, mechanics, boiler makers, steam fitters, blacksmiths, wheelwrights, carpenters, harness makers, upholsterer, hose repairers, painters, drivers, clerks and attendants; the total number is 93 men. Detailed and elaborate accounts of all repairs and costs are kept. The usual practice is to do as little repairing to engines as will keep them in service.

A new repair shop is nearing completion at Twelfth avenue and Fifty-sixth stret. This is a large three-story brick and concrete building with steel frame. It should provide ample accommodation for the repair work of the department.

**Engine Fuel.**—American cannel coal, either Falling Rock or Mill Creek, is used in the engines and gives satisfactory results. Twenty-six fuel stations, generally in engine or ladder houses, are provided throughout the city, in each of which a two-horse fuel wagon stands ready loaded with from one to two tons of coal in iron cans. Additional loads in cans are ready for placing in wagons. Each station contains from 3 to 30 tons of coal. Wagons are drawn to fires by a team of hose wagon horses sent back from the fire for the purpose.

**OPERATION.—Hours of Duty.**—Members are on duty at all times with the exception of from three to four hours daily for meals and two days off every 10 days. One of these days off is for 24 hours and the other for 36 hours, thereby allowing each man 2½ days of liberty out of every 10 in addition to his meal hours; his time off is further supplemented by annual vacations of 14 days for firemen, 21 days for

company officers, and 30 days for chief officers. By these arrangements every private is off duty more than three-eighths of the time and the number of men in quarters is correspondingly reduced. Leaves on account of sickness of any member or of his immediate family are granted without loss of pay, and other leaves involving loss of pay may be given at the discretion of the superior officers. The strength of a 13-man company is frequently reduced during the vacation period to 6 men, one being on vacation, three on day off and three absent at meals. Further absences occasioned by sickness or other causes are usually obviated by detailing men from stronger companies. Vacations and other leaves are generally so arranged that two commanding officers in adjoining districts shall not be absent at the same time.

The present arrangement of 2½ days off in every 10 was reached after an extensive trial of the two-platoon system during the winter of 1904-05, the operation of the system proving to be extremely detrimental to the efficiency and discipline of the department and unsatisfactory even to its advocates among the privates.

Watch is maintained continuously in every department house from 8 a. m. till midnight in four shifts, a single man being on watch. From midnight till 6 a. m., two men are on duty together, and from 6 a. m. till 8 a. m., one man.

**Call Force and Volunteers.**—None. The 17 regular members of engine company 49 on Blackwell's Island generally receive assistance from the attendants at the institutions on Blackwell's, Ward's and Randall's Islands. Six fire engines, 4 chemical engines, 4 ladder trucks, and 13 hose reels are stationed in the care of this company at various points on the three islands.

**Discipline.**—Discipline in the department is in general fair, the obedience of men at fires being prompt and suitable deference being shown to superiors. Rules and regulations are adequate and well drawn up, but are not strictly enforced, and the *morale* of the department is below a proper standard, partly owing to leniency in the treatment of delinquents and partly to the organizations among the privates. The latter, two in number, are ostensibly benevolent associations known as the Boxers and the Pinkeys. It is said that the experimental adoption of the two-platoon system was forced on the department largely through the efforts of one of these associations. A benevolent association for the officers of the department also exists, but does not appear to exert any injurious influence. One of the fire boats was recently out of service for several hours, while engaged in taking some of the fire department officials to a yacht race.

**Drills and Training.**—A regular drill school is maintained throughout the year under the direction of Battalion Chief Farrell, assisted by a captain and lieutenant. New men receive 21 days' training in this school in the use of pompier ladders, rope, nets, hose hoists, life guns, surgical kits, siamese connections and in sending alarms and life saving.

Engineers are instructed at the repair shop for about one month before appointment. Water towers are operated weekly by men detailed for this drill by the battalion chiefs. No other drills or training are required of the regular men after appointment. No regular provision is made for keeping the men in good physical condition other than medical supervision by the four department physicians. Horses are hitched to the apparatus twice daily in every department house.

**Response to Alarms.**—The usual response to alarms in the down town mercantile, residence and other districts is shown in the following table, in which the number of appliances on second and subsequent alarms includes those which have previously responded.

USUAL RESPONSE TO ALARMS.

| MANHATTAN. | Alarm. | Engine Companies. | Ladder Companies. |
|---|---|---|---|
| Downtown Mercantile District | 1 | 4 | 2 |
| | 2 | 8 | 3 |
| | 3 | 13 | 4 |
| | 4 | 18 | 5 |
| | 5 | 24 | 6 |
| Residence District | 1 | 3 | 2 |
| | 2 | 7 | 3 |
| | 3 | 12 | 4 |
| | 4 | 17 | 5 |
| THE BRONX. | | | |
| Mercantile District | 1 | 3 | 1 |
| | 2 | 6 | 2 |
| | 3 | 10 | 3 |
| | 4 | 14 | 3 |
| Residence District | 1 | 3 | 1 |
| | 2 | 6 | 3 |
| | 3 | 10 | 4 |

Twenty or thirty down town boxes call out five engine companies on the first alarm, and five or more on each succeeding alarm.

One of the four water towers usually responds on first or second alarms south of Central Park and to second or third alarms where its services may be required south of the Harlem River.

Fire boats, not exceeding three in number, respond to boxes near the water front.

The chief of the department usually attends all third alarms in Greater New York, all second alarms in Manhattan below Seventy-second street, and at night all fires on Broadway near the wholesale district.

Not less than two deputy or battalion chiefs are present at all alarms, this number being increased to six or seven for four-alarm fires in the down town district.

The chemical engines are used almost exclusively in the outlying portions of The Bronx.

One of the searchlight engines responds after sunset to every second alarm south of Central Park, and both respond to all fourth alarms south of Seventy-second street.

Powerful assistance from distant territory can be brought in by special signals.

The second sections of double companies are intended primarily to protect territory vacated by first sections rather than to respond on second or subsequent alarms to the same fire as the first sections.

A tool wagon responds to fourth alarms with an expert machinist and tools and fittings. One or more supervising engineers attend third and subsequent alarms.

Automatic and pneumatic alarms call out the nearest engine, one ladder truck and one battalion chief.

The response to telephone or other still alarms is governed by the conditions reported, one company being the usual force to answer. The horses in all single companies and in the first section of double companies are hitched on the receipt of all alarms, except at night, when the horses and company are called to the main floor only on selected alarms. On third and subsequent alarms a few engines and ladder trucks are moved into vacant quarters nearer the fire as directed by the running card.

There are no serious obstacles to the response of apparatus other than by occasional snow in winter and by some of the hills in the northern district, where the apparatus is sometimes assisted by the trolley cars. Promptness in response is aided by the establishment of fire streets across which surface cars and other vehicles are expected to move cautiously in order to leave a clear road to the fire department. Some serious accidents have occurred where cars have failed to observe this precaution, but as a rule the requirements are well carried out. Apparatus is frequently delayed for short intervals by traffic in the congested streets. The freight trains on Eleventh avenue are sometimes a serious hindrance. A few grade crossings in The Bronx and elsewhere and the drawbridges across the Harlem River are not serious causes of delay. Collisions with the structure of the elevated railways are of quite frequent occurrence.

**Fire Methods.**—Small fires are frequently extinguished with portable extinguishers carried on the ladder trucks or by buckets. Chemical engines are not used in the city proper, though they are occasionally utilized in the remote parts of The Bronx and on the islands in the harbor. Streams from engines form the main reliance for handling fires and are usually discharged through 1¼-inch or 1⅜-inch shut-off nozzles. Where a small stream is sufficient either a ⅝-inch tip is attached to the nozzle or a few lengths of 1½-inch hose with play pipe is connected to the end of the 2½-inch hose. Siamese streams are seldom used, even in situations which call for their employment, the department preferring a single line of 3-inch hose with 1½-inch nozzle. Water towers with 1¾-inch or 2-inch nozzles are frequently employed, but no provision is regularly made for the response of more than one tower at any fire. Hose is ordinarily raised to the higher stories of buildings by means of rope and hose hoists. Standpipes attached to buildings are used when circumstances warrant, and the engine connections, required by law on many buildings, which supply water for perforated pipes and similar attachments in underground floors are occasionally utilized with good effect against fires in sub-basements and in other smoke-filled locations.

The duty of clearing buildings of smoke, frequently neglected in other departments, is regularly assigned to the second ladder company on the scene, thereby facilitating the prompt work of the hosemen. The solid type of block which prevails extensively throughout the city deprives the firemen of convenient access to the rear of buildings and makes their work the more difficult and slower in consequence. Fire escapes are utilized wherever installed, but these useful aids to the department are frequently wanting. Scaling ladders are used to reach parts of buildings inaccessible to the ordinary ladders, and are called into play with fair frequency, owing to the lack of ladders between 50 and 75 feet in length.

To provide coal for the engines every third or fourth hose wagon driver is sent back with his team for a fuel wagon, according to regular assignments. Hose is properly stowed on the wagons before returning to quarters. The smoke masks provided are seldom used, and are considered unreliable. All engines stand with hot water in their boilers and fires are touched off by hand on leaving quarters. Acid igniters have been tried but found undesirable. The work of the fire boats is assisted by three boat tenders which carry supplies of 3½-inch hose and play pipes and assist the crews of the boats in getting to work. A corps

of sappers and miners, consisting of all assistant foremen, is called for under the city charter, but it is said that the services of this corps have not been utilized for more than 20 years. The first company officer to arrive at a fire is in charge until superseded by a superior. Suitable provision is made so that in the absence of any battalion chief or other officer a subordinate is always on duty to fill his place. Communication is maintained with fire alarm headquarters at all times during fires by one of the chiefs' drivers, who is stationed at the alarm box to receive and transmit signals.

Companies in quarters are not regularly notified either when fires are out or when other companies have returned from alarms.

The work of the department has been frequently handicapped by insufficient water from the hydrants. When these conditions develop it has been the practice to send some of the engines back to quarters instead of siamesing two weak streams to form a powerful one, or instead of stationing the engines at more distant hydrants and utilizing their capacity through two lines of hose siamesed near the fire. In order to concentrate the engines more closely at the scene of action, use is made of a short connection whereby two engines are enabled to draw from a single outlet hydrant. This is of considerable advantage except in those cases where the supply of water from the hydrant is limited. The work of the engines is supervised by two assistant foremen who, in addition to their regular duties, are expected to attend all second or third alarm fires.

**Use of Separate Fire Main.**—None yet installed.

**Building Inspection (by the Fire Department).**—The fire department Bureau of Violations and Auxiliary Fire Appliances makes regular semi-annual inspections of private fire appliances, the condition of fire-escapes, storage of combustibles and general tidiness. The members of every fire company are detailed to this inspection work, subject to the supervision of Battalion Chief W. T. Beggin, who has five regular assistants. Each company commander sends in reports of the inspection of every building in his company district in which fire appliances of any kind are installed or required, and retains a complete record of all such inspections and of the recommendations which accompany the reports. Records are also filed at headquarters and defects are followed up by the bureau until corrected. The time devoted to each semi-annual inspection is between 200 and 300 hours per company. Premises are also inspected where explosive or combustible materials are stored and where licenses are required.

The work accomplished by the bureau in the 21 months since its establishment in December, 1903, is shown below:

BUREAU OF VIOLATIONS AND AUXILIARY FIRE APPLIANCES.

| | |
|---|---|
| Inspections and reinspections by bureau | 6,258 |
| Notices served | 1,391 |
| Violations sent to Corporation Counsel | 315 |

EQUIPMENTS INSTALLED OR CORRECTED BY ORDER OF THE DEPARTMENT.

| | Number of Buildings |
|---|---|
| Standpipes, with connections and hose | 68 |
| Cellar sprinklers or perforated pipes | 78 |
| Alarm connection to fire department | 113 |
| Interior alarm systems | 142 |
| Miscellaneous | 248 |
| | **Number Installed** |
| Fire pails, buckets and barrels | 12,225 |
| Chemical extinguishers, 3-gallon | 1,308 |
| Fire axes and hooks (total) | 1,405 |

**Hydrant Inspection (by the Fire Department).**—Company officers detail one or more men to inspect the 50 to 150 hydrants in their respective districts once every month. The inspection is to keep track of additions and changes in the locations of hydrants. The handle of each hydrant is tried and obviously defective conditions are noted. The hydrants are not flushed. Notices of defective conditions are forwarded monthly by the company officers to the foreman of the nearest water department repair gang. It is said these notices do not always receive prompt attention. Changes in location are reported yearly to water department headquarters, where the distribution maps for the entire city are compiled. In the winter company officers see that all hydrants are pumped out after use and report all frozen hydrants, which are thawed out by one engine in each fire department division.

**Theatre Inspection and Detail.**—The theatres are included in the regular semi-annual inspections by the fire department and their appliances are further inspected once every month. A fireman is detailed to attend every performance and to see that all appliances are in proper working order and the ordinances enforced. Such details make written reports of all violations. During the season between 70 and 75 firemen are required for this theatre duty. Reports of details with recommendations for necessary changes are forwarded daily to the deputy chief.

Beginning November 6, 1905, four lieutenants are assigned exclusively to the work of inspecting theatres, each of which they visit during performances at least every other day and inspect throughout at least once a month. For this purpose the theatres are grouped in four districts, with from 14 to 18 theatres in each. The inspectors are shifted from district to district monthly.

**Reports and Records.**—Suitable forms are provided for reporting all of the routine and

fire business of the department. The data is put on record at headquarters by a large force of clerks under a battalion chief. The annual report of the department is usually a volume of about 300 pages; in it are given details concerning every company, the official record of each member of the department, descriptions of the apparatus in service, fairly complete fire statistics, a résumé of notable fires occurring during the year and reports from the component bureaus.

The chief in his recent reports has recommended additional hydrants, and the installation of a separate salt water fire system. The report for the year ending December 31, 1904, while completed in July, 1905, was not accessible to the public at the date of going to press.

**Recent Improvements.**—Since January 1, 1904, when the present administration came into office, seven engine companies and three ladder companies have been established, while three other companies have been changed from a single to a double basis; a new fire boat has been purchased and another boat has been rebuilt. Nine new engines, ten hose wagons, and a water tower have also been provided. The fire force has been increased from 1,715 to 2,141 men. Three additional 12-hour leaves have been granted the uniformed force each month.

**Improvements Authorized.** — Five new houses have been authorized and are now either under construction or under contract.

House for double engine and ladder company, Duane street.

House for double ladder company, Columbus avenue and 63rd street.

House for double ladder company, 123rd street near Eighth avenue.

House for ladder company, 135th street and Lenox avenue.

House for engine and ladder company, Amsterdam avenue and 161st street.

Additional apparatus has been authorized as follows:

9 new engines.
3 fire-boats (1 for Manhattan).
37,000 feet of hose.

In addition to the appropriation for real estate and for the fire boats, the Board of Estimate and Apportionment set aside $500,000 for extra equipment for 1905. Most of this appropriation will be expended on the extension of the paid department to Queens and Richmond.

**CONCLUSIONS.—General.**—The fire department throughout the larger part of Manhattan and The Bronx is an efficient force, capable of handling all ordinary fires and others of more serious nature even when they have attained considerable headway. These results are obtained more through the power of numbers than through the efficiency of individual companies, for the latter are equipped generally with engines of only moderate size not always in good condition and frequently poorly handled. In proportion to its population, the city is provided with a comparatively small number of companies and the expenses of the department in comparison with the population are low. The growth of the department in recent years has hardly kept pace with the growth in population.

**Organization.**—The system of putting the sole control of the department in the hands of a single official appointed by the mayor is probably as good as can be devised, its excellence depending largely upon the character of the mayor's appointee. One defect of the system lies in giving the commissioner sole power to discipline members. A frequent consequence of placing such power in the hands of a political appointee, is that discrimination is apt to be made in favor of delinquents having powerful political friends. This defect is usually avoided in those departments where the punishing power rests in the hands of the chief. As long as the department is governed by the present city charter, special stress should be laid on the appointment of a commissioner of high administrative ability, free from active political affiliations.

The personnel includes many able and efficient officers; the chief is well qualified to handle men, and is usually ready to make use of improved methods when they are brought to his attention.

The salaries paid to members are unusually large and attract a class of men who make, with comparatively few exceptions, able and brave firemen.

The civil service methods employed for appointment and promotion, while not perfect, provide a fair basis for securing efficient officers, but it is a question whether a system involving non-competitive examinations for promotion and basing the choice exclusively on the previous records of the candidates, would not give better results.

Although most of the companies have very full complements of men, the generous allowance of days off, arrangements of meal hours, details and other leaves, are such that the companies are frequently reduced to a comparatively low standard, engine companies sometimes arriving at fires with only two or three men immediately available for hose duty. This is a result of the extremely liberal treatment given to the men.

The fire districts into which the city is now subdivided are not well arranged, several of them being too extensive for convenient super-

vision. Many parts of the city are deficient in apparatus; the scarcity of engine and ladder companies in several localities resulting in unnecessarily severe fires, and sometimes in loss of life. The service in the more northern parts of the city is not up to the standard maintained in the southerly half, owing chiefly to the more sparse distribution of the apparatus, and lack of ladder companies.

**Equipment.**—The equipment of 93 engines, 49 ladder trucks, 5 fire boats, 9 chemical engines and 4 water towers, although very large, is still hardly commensurate with the size of the city. The engines, while including a fair proportion of first size, show rapid deterioration through hard usage and unskillful handling, so that a comparatively small proportion of those in service can do the work ordinarily expected even of smaller engines in good condition.

Of the eight first size engines which were tested, only two discharged over 700 gallons per minute, while three failed to show a capacity of as much as 500 gallons. These engines, when in good condition with ordinary handling, should discharge their full rated capacity of 900 gallons. The weakness of the engines is clearly shown when it is remembered that 300 gallons of water a minute are required to supply an efficient 1¼-inch stream. Every engine in service in New York should be able to throw two such streams, and yet out of the 32 engines which were tested, only five were able to discharge 600 gallons per minute during a 20-minute run under favorable conditions.

The down-town engines particularly have suffered from lack of proper supervision. This should be remedied by improved methods in training engineers, and by selecting skilled and expert mechanical engineers for supervisory positions, clothing them with authority equal at least to that of battalion chiefs.

The engines in service with the second sections of double companies are in many cases utterly inadequate for the duties assigned them, as in the event of a second fire occurring during the progress of a first, these engines working under less favorable conditions than those in the first sections are expected to protect the city as effectively as their larger and better-manned fellows. In many companies the second section engines are of the fourth size, and more than 20 years old.

The fire boat service includes excellent boats and others in doubtful condition, but permission to obtain accurate information as to the capacity and condition of the boats was refused. The additional fire-boat already authorized for Manhattan will leave one of the older boats available for the protection of the North River water front north of Fourteenth street. The use of a fire-boat as a private yacht should be out of the question.

The list of ladder trucks contains a good proportion of aerial ladders, but the equipment of the trucks is deficient in extension ladders about 65 feet long; as a consequence of this deficiency, considerable use has to be made of the undesirable pompier ladders. These are well handled in the New York department, but are not to be compared with extension ladders for regular service either for saving life or for use in raising lines of hose.

The hose wagons in service are of a good type, and carry a sufficient amount of hose. Their equipment includes almost all the necessary appliances, with the exception of portable chemical extinguishers and chemical tanks.

The chemical engines are relegated to the extreme outlying districts and to the islands in the river. Their valuable qualities have not been appreciated as they deserve.

The search light engines are a specialty of the New York department and are reported to be of considerable assistance, particularly during smoky fires at night.

The water towers are of standard type, but owing to the small number in service, are stationed at wide intervals.

The hose in service is sufficient in quantity and generally of good quality. A good equipment of both 2½-inch and 3-inch hose is assigned to each of the down-town companies.

The use of 2½-inch couplings on 3-inch hose is generally to be recommended as obviating difficulties in handling lines of mixed 2½-inch and 3-inch hose, the employment of special reducers and enlargers being an unnecessary and troublesome makeshift. The change to a single standard size coupling is recommended, although it is appreciated that in this city the many buildings equipped with 3-inch hose connections to their standpipes and the amount of apparatus fitted with the larger size connections, will make the change expensive. The supply of 3½-inch hose for the fire boats is only moderate in amount and should be increased to the exclusion of the 4-inch, 5-inch and 6-inch sizes. The benefits derived from the use of small amounts of these large sizes are insufficient to offset the delays and liability to mistakes involved in their use.

The equipment of 1½-inch hose on many of the hose wagons in the residence and tenement districts, as well as on several ladder trucks, is an excellent provision, even though it cannot be so quickly brought into play as could lines from chemical engines.

The minor equipment is in general excellent, the only possible criticism in some cases being that the apparatus is overloaded, generally an excellent fault. At least one reliable smoke-

mask is desirable on the apparatus responding to every downtown fire.

The horses and harnesses are generally adequate and properly cared for.

The department, with the exception of a few companies, is well housed, and new buildings have been authorized to replace those which are no longer serviceable.

The repair shop now nearing completion should provide adequate repair facilities, which should be placed under the management of an experienced machine shop superintendent rather than that of a graduated fireman. The condition of the engines as shown by the tests indicates a lack of efficiency in the repair department.

The fuel for the engines is well selected and sufficiently well distributed throughout the city.

**Operation.**—The amount of time off allowed members of the department is unnecessarily large. The arrangement of watches at each house with two men during the early morning hours is excellent. The discipline of the department is only fair, being subject to different injurious influences. The training given to new members, though brief, is adapted to make them efficient firemen, but the uniform ability of the companies in their regular duties could be increased by additional regular drills. The instruction given to engineers of steamers has not resulted in a thoroughly efficient corps.

The apparatus responding to alarms is in general well arranged, but the force of engines at some additional dangerous localities should be increased to five or six on first alarms, and a second water tower should regularly respond on second or third alarms to many localities where its services may be needed.

The methods employed by the department for extinguishing fires are in general good, but could be improved by the more frequent use of siamese streams, by an increased supply of chemical apparatus, and by additions to the equipment of the ladder trucks.

The work of the supervisory engineers could be made more effective by including in their duties the supervision of all repairs and the scientific testing of all new and repaired apparatus.

The work of the department at fires generally is intelligent, almost without exception courageous, and usually, though not always, prompt. With the installation of the authorized separate fire main system the methods of the companies in the district so protected will have to be radically changed. The system should be used at all first alarm fires, as well as at those of a more serious nature. The practical elimination of engines from this territory should result in a financial saving to the department as well as in an increased efficiency.

The building inspections carried out by the fire department serve well the double purpose of improving the conditions of the buildings inspected and in familiarizing the company officers and men with the buildings in their districts. The work is carried out with regularity and proper records are kept. The hydrant inspections by the fire department should be unnecessary, but owing to the lax work of the water department they have proved of considerable value, particularly in the discovery of frozen and otherwise defective hydrants.

The detail of firemen to every theatrical performance is perhaps a reasonable service to expect of city employees even though it materially weakens the companies from which the men are drawn. The method employed in other cities where one or more employees of each theater are trained and authorized by the fire department to act exclusively as theater firemen, has given satisfaction and is recommended for adoption in New York. The constant inspections of the theaters is an excellent feature.

The system of reports and bookkeeping is sufficient for most purposes. The fire losses and other statistical data reported by the fire department are somewhat at variance with similar data reported by the fire patrol. It is to be regretted that the value of the annual reports is much reduced by the great delay in their publication. The improvements introduced or authorized by the present administration have somewhat strengthened the department in spite of the additional time off granted to the men.

## FIRE ALARM SYSTEM.

### MANHATTAN.

The engineers of the National Board having closely co-operated with Mr. Kempster B. Miller, the expert employed by the Committee on Fire Alarm Service, Mr. Cecil F. Shallcross, Chairman, of the New York Board of Fire Underwriters, in the construction of the report issued in September, 1905, upon the fire alarm service of the Borough of Manhattan, the conclusions reached and the recommendations made in that report are endorsed and adopted by the National Board.

### THE BRONX.

**ORGANIZATION. — Supervision. —** The Bronx system, with that of Manhattan, forms a bureau in the fire department, and is under the supervision of the fire commissioner. Mr. Reuben Bouton was appointed chief operator of the local system in 1903 when The

Bronx office was established, but his authority is limited to the office work, the system as a whole being directly under the orders of Chief Operator Farrell.

**Membership and Salaries.—**

| | |
|---|---|
| 7 Operators, | $1,200 or $1,500 |
| 1 Batteryman, | 1,000 |
| 1 Lineman, | 1,000 |

The above are attached to The Bronx office. When any extra help is needed it is summoned from the Manhattan office.

**EQUIPMENT.—Type.**—The Bronx system is of the manual central office type equipped with apparatus made in part by Pearce & Jones, and in part by the Gamewell Company. It was installed in 1903, much of the apparatus having previously been in use in Manhattan and Brooklyn.

**Headquarters.**—Headquarters are located on the third floor of engine house 46 at 715 East One Hundred and Seventy-sixth street. This is a 3-story stone and brick building, ordinary construction. The fire hazards include a wooden hose tower which passes through the fire alarm room with openings on the first and third floors and cellar. Adjacent to the tower is a small carpenter shop and supply room. A quantity of paints, oils, much old paper, etc., and fire alarm supplies have collected in the cellar. Fire alarm cables pass directly from the cellar into the hose tower through an opening in the wooden floor. Cables in the cellar are threatened by exciter and a swinging gas jet, in fairly close proximity. No extinguishers above ground floor. A small gas stove with detachable rubber tubing is sometimes used in the battery room adjoining the operating room. Outside exposures moderate.

**Apparatus.**—*Receiving.*—Signals received over the box circuits are recorded on a 16-pen register operated by a relay in each circuit, which also operates a line drop and a buzzer. A 24-pen register stands in reserve.

*Transmitting.*—A 4-dial 3-figure Pearce & Jones transmitter transferred from the Manhattan office is in use for sending alarms over the gong and telephone circuits. Morse keys on each circuit can also be used for this purpose. No mechanical transmitting apparatus is provided for sending signals over the combination circuit.

*Protective.*—Each conductor entering headquarters is provided with a 1-ampere open link fuse and a mechanical circuit breaker for heavy currents.

*Testing.*—A Pearce galvanometer giving approximate indications is used for testing the circuits in connection with grounding switches and a voltmeter. Ground connections are provided at headquarters and at such fire houses as the box circuits enter.

*At Houses.*—The alarm apparatus in houses is similar to that in use in Manhattan, including combination instruments for both routine signals and alarms on the combination circuits, and large gongs. Engine companies 61, 64 and 70 are not provided with gongs. The small bells in these three houses are attached to a box circuit.

*Telephones.*—Four circuits provide accommodation for the department houses in The Bronx, all of which may be rung up simultaneously. Alarm signals are sounded on the telephone bells by the Pearce & Jones transmitter. Headquarters are connected with the Tremont exchange by a single circuit.

**Boxes.**—*Description.*—Total number, 339.

| | |
|---|---|
| Street boxes | 281 |
| Building boxes | 58 |
| Keyless boxes | 76 |
| Detached key boxes | 205 |

Fire alarm boxes are similar to those in use in Manhattan, except that a large proportion are locked boxes with keys detached. Signs are provided at most of these boxes indicating where keys may be found. Boxes are usually mounted on telegraph poles marked with a broad red band, the boxes themselves being painted with aluminum. When inspected the painting made them properly conspicuous. In many cases poles are selected for box locations a short distance from corners of main streets.

*Distribution.*—In the principal mercantile district boxes are distributed with a frequency far from uniform, buildings on Third avenue and its immediate neighborhood south of One Hundred and Seventieth street usually having some box within 500 feet, while the rest of the territory included within the present fire limits contains several localities where buildings are 1,000 feet or more distant from the nearest box. Such points are found at One Hundred and Fifty-sixth street, Washington avenue, Boston road and elsewhere. Most blocks east of Park avenue within the fire limits, however, are provided with some box within 700 feet.

Outside of the fire limits the boxes are located at much wider intervals even in some fairly well built-up districts, such as Wakefield, West Farms, Tremont, etc. No boxes are provided in or near Eastchester, Baychester or several other outlying sections containing valuable residences and other buildings.

**Circuits.**—Circuits are 15 in number, including 8 box circuits, one gong circuit, one combination circuit, 4 telephone circuits, and one circuit to Tremont police station. They are all overhead, with the exception of a few hundred feet of cable adjoining headquarters.

Much of the iron wire which was previously in use has been replaced by copper wire covered with "Safety" insulation. Box circuits are all-metallic and normally closed, and include one circuit from Manhattan headquarters, on which 34 Bronx boxes and several Manhattan boxes are connected. None are normally grounded. The largest number of boxes on any one circuit is 53. Adjacent boxes are generally on the same circuit. It is reported that no high tension wires are carried on the same poles as the fire alarm circuits. The establishment of The Bronx office relieved the Manhattan headquarters of some of its longer circuits, and in most cases obviated the necessity for circuits crossing the Harlem river.

**Batteries.**—A total of 340 gravity cells furnish the current for the 8 box circuits. Duplicate batteries with 165 sal-ammoniac cells in each provide current for the gong and combination circuits, and are in service alternate days. Batteries are mounted on wooden racks in the battery room adjoining the operating room. The battery room and batteries are kept in only fairly neat condition.

**OPERATION.—Routine and Maintenance.**—Operators work in three shifts, with two men on duty at all times. Besides transmitting alarms the operator in charge supervises trouble repair work and keeps a record of tests, line troubles, signals, etc. Tests on the circuits are made at irregular intervals daily and batteries are tested each morning. Boxes are tried at rare intervals by an operator detailed for the purpose, the last regular inspection having been made five or six months before the inspection by the National Board engineers.

No employees respond to alarms. One trouble man is on duty daily from 8 A. M. to 6 P. M. to remedy trouble on the circuits; at other hours, if assistance is required, it must be sent from the Manhattan headquarters.

**Alarm Transmission.**—*Box Alarms.*—Alarms from boxes are sent out to The Bronx fire companies over the gong and telephone circuits by means of the dial transmitter and over the combination circuit by means of a Morse key. There is no means of cross-connecting box and gong circuits at headquarters for automatic transmission, but alarms from the box circuit covering the northeast portion of the borough can be sounded directly in the nearest three engine houses by throwing in additional battery at headquarters. Alarms are sent to the Tremont police station, Lebanon hospital, The Bronx borough hall, fire patrol company No. 6, and sometimes via Manhattan headquarters to the nearer Manhattan companies.

*Telephone Alarms.*—Telephone alarms are forwarded according to the judgment of the operator, either by telephone to the nearest engine company, or by sounding an alarm from the nearest box.

**Recent Improvements.**—Much of the old iron wire has been replaced with copper.

**Improvements Authorized.**—At the present time the gong and combination circuits are being divided into two circuits each.

**CONCLUSIONS.**—The Bronx system provides only a moderately reliable service, owing to the presence of several undesirable features in the equipment. These include the use of exclusively overhead construction, lack of complete alarm equipment both for sending signals over the combination circuit, and for their reception at some of the houses. The location of fire alarm headquarters involves a considerable element of danger, as the building is of ordinary construction and contains considerable unnecessary internal hazards. The apparatus is largely similar to that in use in Manhattan and has similar defects, the boxes being generally of the same objectionable type, though not equipped in many cases either with keyless doors or with red lights. They are of the detached key type with key-signs posted near each box. The distribution of boxes in the borough is good in parts of the mercantile section; elsewhere from fair to very poor. Boxes are painted with fair frequency, but are not always conspicuously placed. The unnecessary instruments on the combination circuits, the use of primary batteries, and the infrequency of the tests, are all open to criticism. The force, both of operators and linemen, is sometimes inadequate.

## FIRE DEPARTMENT AUXILIARIES.

**SALVAGE CORPS OR FIRE PATROL.**

**—Organization.**—*Control.*—The fire patrol is maintained by the New York Board of Fire Underwriters under the supervision of a committee of ten members, including the officers of the board, with Mr. W. B. Ogden, chairman of committee; secretary, E. S. Terhune. Members are elected annually, and are usually re-elected, those now on the committee having served from 2 to 15 years.

*Superintendent.*—The active force is under the direct management of a superintendent appointed by the committee for an indefinite term, usually selected from the officers of the fire patrol. The present incumbent is Richard S. Groves, who was appointed to the position in 1899. He has been connected with the service since 1868.

*Membership.*—Total membership, 148.

1 Superintendent.
6 Captains.
6 Lieutenants.
9 Sergeants.
71 Permanent Patrolmen.
48 Auxiliary Patrolmen.
1 Cover Mender.
1 Storekeeper.
5 Janitors.

*Companies.*—Of the six companies in service, three are stationed below Forty-second street. To each of these, 18 to 22 permanent men are assigned in addition to 8 or 14 auxiliaries. Each is divided into two sections in order to respond to two fires occurring simultaneously. The more northern companies each have from 10 to 13 permanent men, with 4 auxiliaries. A seventh company is soon to be established in the lower east side.

**Equipment.**—The equipment includes nine 2-horse patrol wagons in regular service, seven 1-horse wagons in reserve, 2,423 tarpaulin covers, including both stock and roof covers, the usual size being 12 feet by 18 feet. Each wagon in service carries one 16-foot extension ladder, chemical extinguisher, hooks, axes, door-openers, brooms, shovels, buckets, ropes, squilgees, sprinkler heads and small tools. Each of the wagons above Forty-second street carries in addition two pompier ladders. A fire engine of the Silsby type, of 600 gallons rated capacity, is stationed with company No. 1, and is used to pump out cellars.

**Operation.**—One patrol wagon responds to every bell, telephone or still alarm south of One Hundred and Fifty-eighth street in Manhattan and practically all of The Bronx south of One Hundred and Seventy-seventh street; on second alarms the remaining territory in the limits protected by the fire department is covered by one wagon. Special signals call additional wagons or companies whenever their services are needed. Assignments are made so that vacant stations shall be properly covered by a detachment from an adjacent company. Companies hitch on all alarms; this has involved calling the men to the main floor as often as 19 times in a single night. Suitable reports are made of each fire attended and full records are kept, including data relating to the construction and occupancy of buildings, cause and extent of fires, valuation and insurance. These data have been published *in extenso* in reports previous to the year 1904. The corps works in harmony with the fire department.

**FIRE MARSHAL.—General.**—The fire marshal's bureau forms a part of the fire department, the fire marshal being appointed by the fire commissioner without power of re-

TABLE No. 17.—FIRE PATROL COMPANIES.—LOCATION AND EQUIPMENT.

| Company No. | Location. | MEN. | | Apparatus. | Covers Carried. | Covers in Reserve. | Ladders Carried. | Extinguishers. |
|---|---|---|---|---|---|---|---|---|
| | | Permanent. | Auxiliary. | | | | | |
| 1 | 41 Murray St. | 22 | 14 | Patrol Wagon.<br>Patrol Wagon.<br>Reserve Wagon.<br>Old Fire Engine. | 20<br>20<br>15 | 425 | 1—16 ft.,<br>1—16 ft. | 1—4-gallon.<br>1—4-gallon. |
| 2 | 31 Great Jones St. | 22 | 14 | Patrol Wagon.<br>Patrol Wagon.<br>Reserve Wagon. | 20<br>20<br>15 | 430 | 1—16 ft.<br>1—16 ft. | 1—4-gallon.<br>1—4-gallon. |
| 3 | 240 West 30th St. | 18 | 8 | Patrol Wagon.<br>Patrol Wagon.<br>Reserve Wagon.<br>Supt.'s Wagon. | 20<br>20<br>15 | 553 | 1—16 ft.<br>1—16 ft. | 1—4-gallon.<br>1—3-gallon. |
| 4 | 113 East 90th St. | 13 | 4 | Patrol Wagon.<br>Reserve Wagon. | 20<br>15 | 270 | 3 | 1—3-gallon. |
| 5 | 307 West 121st St. | 12 | 4 | Patrol Wagon.<br>Reserve Wagon. | 20<br>10 | 280 | 3 | 1—4-gallon. |
| 6 | 838 Courtland Ave. (Bronx) | 10 | 4 | Patrol Wagon.<br>Reserve Wagon.<br>Spare Wagon.<br>Supply Wagon. | 22<br>11 | 202 | 3 | 1—3-gallon. |

moval except for cause. The bureau has jurisdiction over Manhattan, The Bronx and Richmond.

**Personnel.**—The present fire marshal, Mr. Peter Seery, was appointed in 1898. He entered the fire department in 1877, serving as inspector of combustibles. After four years' service as marshal he was removed by the fire commissioner, but was reinstated by the Supreme Court two years later. Mr. Seery is now well advanced in years. He is assisted by a force of seven assistant fire marshals, four detailed members of the fire department, and two police officers, the latter to serve subpoenas and make arrests; also by a clerical force of two.

**Duties.**—The city charter directs that the fire marshal shall investigate the circumstances of all fires which cause loss, particularly those resulting from carelessness or incendiarism. He is required to furnish the district attorney with such evidence as support charges of arson, which in the New York code includes setting on fire any building with the intent to secure insurance. The marshal has power to subpoena witnesses for his investigations and must submit reports to the fire and police commissioners, the district attorney, the New York Board of Fire Underwriters and others interested. It is also the duty of the fire marshal to enter buildings, to examine heating appliances, kettles, flues, chemical apparatus and other things which may be dangerous in causing or promoting fires. He reports such defects to the fire commissioner and orders their removal or alteration. In case of neglect to comply with his requirements within a set time, the marshal is authorized to have the changes made, the offending party paying the costs in addition to a fine of $50. The fire marshal is further expected to investigate violations of the fire commissioner's orders or non-performance of duty on the part of any member of the fire department. Records are required of all operations of the bureau. The fire marshal's duties appear to be fairly well performed.

The following table gives a summary of the work of the bureau in recent years:

ACTION OF FIRE MARSHAL'S BUREAU.

| Year. | Complaints. | | | Arson. | |
|---|---|---|---|---|---|
| | Number. | Disposed of Satisfactorily. | Pending December 31. | Arrests. | Convictions. |
| 1900,.... | 1,281 | 993 | 288 | 38 | 6 |
| 1901..... | 669 | 394 | 275 | 32 | *1 |
| 1902..... | 552 | 517 | 35 | 35 | 18 |
| 1903,.... | 692 | 669 | 23 | 29 | 12 |

* One died pending trial.
The present marshal was not in office in 1902 and 1903.

**POLICE DEPARTMENT.—Organization.**—*Supervision.*—The police department is under the supervision of a commissioner appointed by the mayor for a term of five years subject to removal for cause by the mayor or governor. The present commissioner is William McAdoo, who was appointed January 1, 1904. His powers and responsibilities are extensive. He makes all appointments and promotions from a list furnished by the municipal civil service commission and is assisted in his duties by two deputy commissioners.

*Membership.*—The membership of the entire department (Greater New York) on September 1, 1905, included 8,465 members, of whom more than half were assigned to duty in Manhattan and The Bronx.

| | |
|---|---|
| Active force | 8,286 |
| Clerical force | 39 |
| Telegraph Bureau force | 27 |
| Miscellaneous employees | 110 |
| Total membership | 8,465 |

The active force is organized as follows:

ACTIVE FORCE.

| | | Annual Salary. |
|---|---|---|
| 2 | Inspectors | $5,000 |
| 14 | Inspectors | 3,500 |
| 69 | Captains | 2,750 |
| 352 | Sergeants | 2,000 |
| 252 | Detective Sergeants | 2,000 |
| 429 | Roundsmen | 1,500 |
| 6,897 | Patrolmen | from 800 to 1,400 |
| 23 | Surgeons | 3,000 |
| 181 | Doormen | 1,000 |
| 67 | Matrons | 1,000 |
| 8,286 | Total. | |

The salary of patrolmen is increased through six grades, reaching the highest after five years' service. The force in the Greater City is divided into 84 precincts, as follows: Manhattan, 34; The Bronx, 8; Brooklyn, 33; Queens, 7; Richmond 2. Each precinct has one or more stations and is commanded by a captain. In addition to the division into precints, the force is assigned to several bureaus or squads, including the following: Traffic Squad, Tenement House Squad, Sanitary Squad, Telegraph Bureau, Boiler Inspection Squad, and several more. The duties of the Boiler Inspection Squad, which is under the supervision of a sergeant, includes the annual inspection of all boilers carrying a pressure of 10 pounds or more and the examination of all stationary engineers, including those operating steam fire engines.

**Equipment.**—The department has in service 25 patrol wagons, 6 patrol launches and one patrol steamer in the Borough of Manhattan, and 8 patrol wagons in the Borough of The Bronx. Patrol wagons are provided with

stretchers, but not ropes. They are usually located at stables a block or two away from the police stations, and are not equipped with quick hitching harness. The patrol steamer, which is stationed at Pier A, in addition to rapid-fire guns and life saving equipment, is provided with a fire pump of about 800 gallons capacity; two turret nozzles, with 1½-inch tips; six 2½-inch hose outlets; 300 feet of 2½-inch hose and four play pipes, with 1-inch nozzles.

**Fire Service.**—Alarms of fire are received by a bell on the gong circuit at police headquarters and are thence forwarded to the precinct in which the fire occurs by telephone. From three to eight reserve patrolmen respond, and upon arrival at the fire the police officer in charge reports to his station and if necessary calls for additional reserves. The fire detail is sent in a patrol wagon from all stations where such wagons are in service. On second alarms, about 30 reserves respond from adjacent precincts, between 20 and 30 more being sent to third alarms. The response is not definitely arranged, and depends largely upon the report received from the fire. Fire lines generally are not roped off, but the police usually keep the crowds well in hand. The large number of persons admitted within the lines on passes are sometimes a hindrance to the fire department.

Some complaint has been made of the lack of vigilance shown by the police in discovering fires, and in some cases the complaint appears to be well founded. In 1903 the police were credited with sending in 226 alarms of fire in addition to a presumably fair proportion of the 7,358 alarms sent in by unknown persons.

**Police Signal System.**—A system of 661 patrol boxes was installed by the New York Telephone Company during 1903 and 1904, and is maintained by that company. The patrol boxes are provided with telephones arranged six on each circuit, each circuit terminating in the precinct station house. Patrolmen report hourly at the boxes, but usually employ fire alarm boxes for sending alarms of fire.

**WATER DEPARTMENT.**—The water department sends notice to the nearest fire company whenever mains or hydrants are closed in any district, similar notice is given when water is again turned on. Such notice is forwarded to all neighboring fire department companies by the battalion chief. The water department does not send employees to fires, nor is it provided with means for receiving alarms.

**STREET DEPARTMENT.**—The street department, through the foreman of a repair gang, notifies nearest fire company, either verbally or by telephone, when streets are closed. This notice is forwarded to neighboring companies. A list of these obstructed streets is kept prominently posted in the quarters of each adjacent company.

**PUBLIC SERVICE CORPORATIONS.—The Metropolitan Street Railway Company** has 7 trouble stations, each provided with an emergency wagon and employees constantly in attendance, but no fire alarm gongs. When a car is blocked by a fire, the conductor notifies company headquarters and the nearest trouble wagon is sent out. The men responding with the wagon systematically carry out the instructions of the officer in charge of the fire.

**The Manhattan Elevated Railway Company** has watchmen and repair men constantly on duty in several gangs. In case of blockade by fire, the nearest gang is sent to the scene. Current is shut off from the company's lines when ordered by the fire department. Telephones are provided at every elevated station, but no fire alarm gongs. The Third avenue stations south from East Sixty-seventh street are equipped with alarm boxes.

**The Union Railway Company** operates overhead trolley lines in the principal streets in The Bronx, and does not send any employees to fires.

**The electric light** and the **gas companies** do not send men to fires, but the former always shut off current from any section when requested by the fire department.

**TELEPHONE SERVICE.—The New York Telephone Company** operates a system with about 180,000 telephones in Manhattan. A pay station, with conspicuous device, from which fire calls may be sent without charge, can be found in almost every city block. The service is handled at 17 main exchanges in Manhattan and The Bronx, with a few minor exchanges at the extreme north of the city. The main buildings are all of fireproof construction and are kept in excellent condition. Three trunk lines connect fire alarm headquarters at East Sixty-seventh street with the Plaza exchange, and one wire connects The Bronx fire alarm operating room with the Tremont exchange. Although fire calls are given the right of way over other business by the telephone company, but little use is made of these facilities for sending alarms of fire, preference being very properly given to the regular fire alarm system. In 1903 the fire department records show 52 alarms received over the public telephone, or less than 1 per cent. of the total.

**LOCAL ALARM SYSTEMS.—The Manhattan Fire Alarm Company** provides 623 subscribers with auxiliary boxes, which are ar-

ranged to operate the nearest street fire alarm box. The number of boxes in the different equipments varies from 1 to 19, a total of 2,065 boxes being in service. All are of the Gamewell auxiliary type, which, when operated, provides for a return signal to give notice that the alarm is being transmitted by the street box. The system involves normally closed circuits with open circuit batteries to transmit alarms. Local circuits and bells give notice of troubles on the circuits. The latter are generally well constructed, using rubber covered copper wire. The premises of 220 subscribers, including most of the large equipments, are wired in accordance with the requirements of the New York Fire Insurance Exchange. About two-thirds of the equipments connect with the fire alarm boxes by overhead wires, the others having underground connections. Equipments are inspected by the underwriters before approval, and after approval are inspected weekly by the six inspectors employed by the Manhattan company. Unapproved equipments are inspected every two weeks. Eight linemen are available during working hours for repairs. Cards directing persons operating auxiliary boxes to proceed at once to the street box are conspicuously posted at each station. The running card of the fire department contains a list of the premises connected by this system to each box.

Auxiliary boxes were used 55 times in 1903 to transmit alarms of fire.

**The Automatic Fire Alarm Company** has about 1,300 subscribers to its system, which provides automatic, manual and sprinkler alarm equipments. The central station of this company is located on the eighth floor of the fireproof building at 418 Broadway. Exposed windows are shuttered and inside standpipe with 2-inch hose and tank supply is provided. Condition of premises good. The thermostat equipments are arranged to indicate the story and building affected, and can also be operated by means of a push button. Where manual boxes are provided they are made non-interfering and in many cases equipped with successive mechanism. The sprinkler alarms have distinctive signals for flowing water and for high and low water in tank. Circuits are 46 in number and are all normally closed and all metallic. Energy is derived from two batteries of chloride accumulators charged from a 120-volt lighting circuit. Local circuits are operated by gravity batteries. The central battery room is well kept and free from hazards. Alarms are recorded on a 40-pen register at the office and are transmitted over a special circuit to fire alarm headquarters, the fire patrol, police headquarters and the New York Real Estate Association by means of a 3-dial manual transmitter. Telephone connections with fire alarm headquarters are provided in addition to the special transmitter circuit. An automatic device tests all circuits every five or ten minutes. At least two operators are on duty in each of the two night shifts and three or four during the day shift. Ten linemen or inspectors are available days and two are on duty at headquarters at night. A large construction gang is available for trouble duty during the day time. Batteries are under constant test and boxes are tested once every two weeks by operating them. Equipments are inspected monthly. Test boxes are attached to the outside of each equipped building for locating troubles. This company transmitted 110 alarms of fire (about 1½ per cent. of the total number of alarms) during the year 1903.

**The Consolidated Fire Alarm Company** provides both automatic and manual fire alarm service and sprinkler supervision to about 548 subscribers. Headquarters are located in a fireproof office building at 37 East Eighteenth street, having all openings shuttered and protected by sprinklers and standpipe. The equipments make use of pneumatic thermostats attached to ½-inch pipe operating appropriate mechanism in a transmission box. The latter includes a break wheel transmitter which signals the location to the office of the company. Other equipments make use of electrical thermostats. Every equipment of both systems includes at least one manual box by which alarms may be transmitted. Boxes are of the interfering type and are not successive. Signals are forwarded from the company's office to fire alarm headquarters by means of a Morse key. They can also be transmitted automatically when desired. A pen register records outgoing signals. The pneumatic systems are tested from time to time.

This company sent in 78 alarms of fire (1 per cent. of total) in 1903.

**The Special Fire Alarm Electrical Signal Company** at 44 East Twenty-third street furnishes manual fire alarm service to about 600 subscribers. The central station of this company is located at fire alarm headquarters. Boxes are of the ordinary type, making use of brushes on a break wheel. Signals are transmitted over 12 all-metallic normally closed box circuits and are recorded by a 16-pen register at headquarters. About 80 per cent. of all wires are underground and are leased from the New York Telephone Company. The system also makes use of electrical thermostats on the same circuits as the manual boxes. Systematic records of troubles and tests are kept. All installations are inspected monthly and reports of all tests are sent to the New York Fire Insurance Exchange. Energy is supplied by gravity batteries located wherever most convenient for each of the 12 circuits. At least one

operator is on duty at headquarters throughout the day. Six linemen are regularly employed to inspect boxes and follow up trouble. Boxes are tested by sending alarms after proper notification. Boxes located in theaters are pulled each evening by the firemen on special duty.

The American District Telegraph Company has recently obtained control of this signal company.

In 1903, 14 alarms were transmitted by this system.

**CENTRAL STATION WATCH SERVICE.—The Holmes Electric Protective Company** provides a central station watch service for about 140 subscribers. Signals are sent to five central stations located between Cortlandt and Thirty-ninth streets. Leeway of ten minutes is allowed after signal from watchman is due before a man is sent to investigate. Two men are sent to alarms of fire, 12 men being available at each station. Boxes of unsubstantial construction are connected to 42 normally closed circuits, the maximum number of boxes on any circuit being 50. Energy is supplied by duplicate storage batteries. The equipment is old and needs overhauling. This company also provides burglar alarm service to about 1,300 subscribers.

**PRIVATE PATROL SERVICE.—The Holmes Electric Protective Company** maintains a corps of 120 patrolmen in Manhattan with special police powers, who guard the property of subscribers during night hours, each man having a limited patrol district. They are reported to be efficient in discovering fires and sending in alarms.

**The Mercantile Electric Company, the Metropolitan Electric Protective Company, the United States Electric Protective Company & Luxemberg-New York Patrol** and the **Manhattan Protective Company** maintain each a corps of from 8 to 15 night patrolmen. The territory covered includes a part of the financial district and other parts of the city south of Forty-second street. All four companies are essentially for protection against burglary.

**PRIVATE FIRE APPARATUS.—General.**—Private fire brigades with different amounts of apparatus are maintained at most of the large department stores, many of the theatres, steamship piers, railroad yards, hotels and public institutions. The organizations and equipments are intended primarily for the protection of the individual premises, although the tugboats belonging to the railroad companies have proved of assistance at fires on neighboring properties.

About sixty private fire brigades were inspected, including those in stores, hotels, hospitals, theatres, gas plants and piers. They are usually composed of employees who ordinarily have other duties. None of them is under the supervision of the New York fire department, though several have regular drills directed by ex-firemen. Many have attained a considerable degree of efficiency, notably those of the R. H. Macy Co., John Wanamaker, New York Theatre, Proctor's Theatre, Bellevue Hospital, St. Luke's Hospital, the railroads, and many piers on the North River. The conditions found in the different brigades are summarized as follows:

**Department stores** are apt to have efficient private brigades owing in part to the relatively low cost of equipment required, the facilities for convenient location of fire appliances and the intelligence of the employees.

**Hotels** of the best class approximate the excellence of the better department stores, but in most the management deems it sufficient to provide apparatus and occasionally instruct employees without organizing special companies or instituting drills.

**Theatres,** although all equipped with fire apparatus are generally deficient in organization. Employees are seldom instructed and not often drilled.

**Hospitals** where private brigades are maintained show fairly satisfactory conditions.

**Gas plants** generally maintain considerable private protection, as fires can be handled better by employees with their ready knowledge of the location of pipe lines than by the city department. With one or two exceptions, conditions in the private brigades were unsatisfactory. The small height of buildings and class of men employed offer opportunities for efficient private organizations.

**Steamship piers** have come to maintain private fire brigades as a necessary adjunct, owing to the large area, frame construction, valuable and often combustible contents and rather serious traffic hazard involved. The brigades are generally found to be handicapped by small size of pipes, inadequate supply of pails, etc., and pumps of insufficient capacity.

**Railroad Companies.**—*The New York Central & Hudson River Railroad Company,* in addition to land fire companies at the different yards and piers, all of which are drilled and maintained under the supervision of a retired captain of the New York fire department, has a fleet of 19 tugs on the two rivers. These boats carry from 200 to 300 feet of 2½-inch hose and two nozzles, and are all equipped with fire pumps of capacities ranging from 250 gallons to 1,500 gallons per minute. The largest 12 boats are provided with turret nozzles. Steam is kept up at all times while each boat is in commission, and pumps and hose are given weekly tests on all boats. Usually three

or four boats are at the Sixtieth street yard, North River. Tugs are called by whistle signal at Sixtieth street or by telephone at the various piers.

*The New York, New Haven & Hartford Railroad Company* has 17 tugs in service, each equipped with at least 200 feet of 2½-inch hose with two nozzles and fire pumps varying in size from 250 to 750 gallons per minute capacity. Turret nozzles are mounted on the largest three. All apparatus is given a weekly test. Four or five of the boats are usually on duty at the Harlem River yards, and can be called by whistle from either yard or by telephone at the various piers. This company also has brigades at its piers on the East River, which have handled several fires in recent years without calling for the assistance of the city department.

**OUTSIDE AID.**—In case of emergency, aid could be obtained from Brooklyn, Queens, and several cities of eastern New Jersey, all of which combined have a total of nearly 150 engines in service. The engines which could be expected from these cities would, in addition to those in New York, probably be all that could be used to advantage at any single fire. In addition to the Brooklyn fire boats, 80 or more tugs about New York Harbor are equipped with fire pumps. All of the neighboring fire departments are provided with 2½-inch couplings of dimensions similar to those used in New York.

**CONCLUSIONS.—Fire Patrol.**—The fire patrol is a fairly efficient force with a membership and equipment of moderate strength. The proposed additional company will strengthen the corps materially.

**Fire Marshal.**—The fire marshal is given ample authority to execute the duties usually required of the office, and though provided with but a small force of assistants does effective work towards correcting defective conditions and prosecuting incendiarism. The records of the office are properly kept.

**Police Department.**—The police department from a fire protection point of view is a fairly efficient force. The large number of patrolmen on duty at all times throughout the city adds materially to the security of the city against fire, even though in some cases the vigilance of individual officers may be lax.

**Water Department.**—The immediate co-operation of the water department is limited to giving notice of closing and opening mains.

**Street Department.**—The street department keeps the fire department properly informed of closed streets.

**Public Service Corporations.**—None are regularly notified of fires, but the railway companies in Manhattan co-operate willingly when requested. The absence of the electric light company and gas company employees from fires adds an unnecessary element of danger. Companies in other cities frequently send employees in their own interests.

**Telephone Service.**—The telephone service throughout the city is good and widely distributed. The use of telephones for sending alarms of fire is, as it should be, comparatively infrequent.

**Local Alarm Systems.**—The auxiliary alarm system is maintained under suitable supervision and serves to save time in sending alarms from extensive premises. The automatic systems of different types afford additional protection, although the installations are not all up to the requirements of the National Board.

**Central Station Watch Service.**—The central station watch service has not been extensively developed. The equipment used is below the proper standard.

**Private Patrol Service.**—The private patrolmen employed by several companies supplement to a slight extent the work of the police department in discovering fires.

**Private Fire Apparatus.**—The private fire departments maintained in a large number of establishments throughout the city, as a rule, show little of the preparation for fire service which characterizes professional departments, and their operation with but few exceptions may naturally be expected to fall short of the professional standard. They are, however, of material value when well maintained. The tug boats of the railroad companies afford some additional protection to portions of the water front.

**Outside Aid.**—The fire department is not likely to require assistance from the outside, but if aid should be needed it is to be found near at hand in ample force.

# STRUCTURAL CONDITIONS AND HAZARDS.

## BUILDING DEPARTMENT.

**ORGANIZATION.— General.—** The "Revised City Charter of 1901" provided a building code for all boroughs of Greater New York, but the supervision and control of building construction is a function of each borough. By the provisions of the charter, the president of each borough is empowered to appoint for two years a superintendent of buildings who, as the executive of the Bureau of Buildings, shall enforce all ordinances or regulations relating to construction, alteration or repair of buildings in the borough. Qualifications for appointment are that he be a competent architect, engineer or builder of ten years' practical experience.

**Manhattan.—**The superintendent of buildings appoints his assistant superintendent, secretary and chief inspector, who must have had 10 years' previous experience as architect, engineer or builder. All other appointments are subject to civil service rules. The Bureau is subdivided into three divisions, engineering, clerical and inspection.

The engineering division checks strength of materials, approves all plans and specifications, examines by means of practical tests all systems of fireproof construction and makes investigations into special structural details, such as unsafe buildings, means of egress and foundations.

The clerical division conducts the routine office work of filing plans and records.

The inspection division is composed of one chief inspector, 64 inspectors of carpentry and masonry, 8 of steel construction, 12 of elevators and 23 of plumbing; besides clerks, typewriters and messengers. All inspectors are required to have had five years' practical experience as either architects, engineers, masons, carpenters, plumbers or iron-workers.

It is unlawful for any employee of the Bureau to be interested in any building trade business while holding office.

**Bronx.—**The superintendent appoints his assistant superintendent and secretary; all other appointments are subject to civil service rules. The Bureau has three divisions, as follows:

The engineering, which examines and approves plans and specifications; the inspection, with 21 inspectors of construction, 2 of steel work, 12 of plumbing and 2 of elevators; and the clerical, which receives and files plans and compiles records.

**Personnel.—***Manhattan.*—The chief officials of the Bureau are as follows:

Mr. Isaac A. Hopper, superintendent, appointed January, 1904, prior to which was a contractor and builder in this city.
Mr. Joseph Gordon, assistant superintendent, appointed August, 1905; formerly a building contractor.
Mr. Bernard J. Gorman, chief inspector, appointed January, 1904; formerly a contractor.
Mr. Rudolph P. Miller, chief engineer, appointed December, 1895; 15 years' previous experience as civil engineer.

| | | |
|---|---|---|
| Four assistant engineers, salary | $2,250 | |
| Chief clerk, " | 3,000 | |
| Assistant chief clerk. " | 2,000 | |
| One inspector, " | 2,400 | |
| 107 inspectors, " | 1,200 to | $1,500 |
| Clerks, typewriters and messengers, salary | 750 " | 1,200 |

Making a total of 185 employees in the Bureau.

*Bronx.*—The present occupants of office are as follows:

Mr. Patrick J. Reville, superintendent, appointed April, 1903; prior to appointment, a contractor and builder since leaving school.
Mr. Michael Hecht, assistant superintendent, appointed January, 1902; formerly a contractor.

| | | |
|---|---|---|
| Secretary and chief clerk, salaries | $2,500 and | $2,100 |
| One assistant engineer, salary | | 2,100 |
| One inspector, " | | 1,800 |
| 46 inspectors, " | | 1,350 |
| Clerks, typewriters and messengers, salary | 900 to | 1,200 |

Making a total of 74 employees in the Bureau.

**Quarters.—***Manhattan.*—The Bureau occupies six floors of the building located at the southwest corner of Eighteenth street and Fourth avenue, where office accommodations seem adequate, but are in urgent need of better storage facilities for safe filing of plans and records.

*Bronx.*—In the new Borough Hall at the southeast corner of Third and Tremont avenues (One Hundred and Seventy-seventh street). Accommodations are adequate for present needs.

**Expenses.—***Manhattan.*—The cost of maintaining the Bureau during the past three years is as follows:

| | |
|---|---|
| 1902 | $250,500 |
| 1903 | 259,550 |
| 1904 | 259,550 |

*Bronx.*—The cost of maintaining the Bureau during the past three years has been as follows:

| | |
|---|---|
| 1902 | $92,000 |
| 1903 | 92,000 |
| 1904 | 91,500 |

**Records.—**Plans, specifications and blank forms with full description of proposed build-

ings are systematically filed in the office, accessible to inspectors during the progress of erection, and on completion of construction they and the inspectors' daily reports are permanently filed for future reference. Methods of filing are complete and satisfactory, but storage facilities are overcrowded in Manhattan.

**Inspection.**—The various inspectors are assigned to regular districts of the city. Besides visiting all buildings under construction in their districts, they must examine existing buildings that have become unsafe by reason of fire, age or other causes. The number of daily inspections varies from 10 to 15 buildings in the various districts. In the smaller districts, buildings under construction are visited daily, while in the larger they are inspected every two or three days. Inspectors keep a daily journal giving time of visit, progress and condition of new buildings. It is permanently filed for reference.

Tenement and apartment houses under construction are also inspected regularly by the Tenement House Department.

**Permits and Appeals.**—With each set of plans and specifications there are filed descriptive data of proposed buildings on regular forms, which are checked by the engineering staff. Violations of laws are noted and plans returned for correction. Upon approval of engineers and superintendent a permit is granted architect or contractor. No fees are charged for building permits.

Before permits are granted for tenement or apartment houses, the plans must receive the approval of the Tenement House Department, and should vital violations be found by the building department, the plan must have a second approval from the Tenement House Department before a permit can be issued.

Appeals from the decision of the superintendent of buildings, where the amount involved exceeds the sum of $1,000, are heard by a Board of Examiners appointed by the mayor annually. This Board is composed of seven members, consisting of the architectural, underwriters, real estate and master mechanic representatives, with Mr. Walter Cook, architect, as chairman, and meets once a week. Members receive $10 each for each meeting attended. The superintendents have been sustained in all but two cases, and these were in Manhattan.

**Tenement Supervision.**—The Tenement House Department, organized January, 1902, has a force of 200 inspectors making daily inspections of new and existing tenement or apartment houses throughout Greater New York, controlling fireproof construction of stairs, entrance halls and vertical shafts, construction and maintenance of fire escapes, and the ventilation and sanitation of premises. A systematic progress card is maintained for each new building, showing conditions at each inspection. Inspectors of this department and those of the Bureau of Buildings notify one another in writing of any violations they may discover.

**State Supervision.**—The Bureau of Factory Inspection of the New York State Department of Labor has general supervision of the construction of fire escapes, enclosing of stair and elevator shafts and sanitation of premises where one or more persons are engaged in manufacturing. The inspectors confer with the Bureau of Buildings before enforcing provisions of the law affecting construction.

**BUILDING LAWS.—General.**—The building code comprises mostly laws adopted under the Revised City Charter of 1899, becoming operative in 1900, and which have been constantly amended to suit new conditions, the last amendment being May 24, 1904. The Municipal Assembly is empowered to establish and from time to time amend a code of ordinances known as the Building Code.

A brief synopsis of the principal provisions relative to fire protection follows:

**Fireproof Construction.**—Required in hotels, schools, theatres, hospitals, lodging houses and jails, over 35 feet high and in all other buildings over 75 feet high. In buildings over 150 feet high, wooden window frames and finish must be fireproofed. The provisions with respect to structural iron and steel work are specific as to dimensions and leave no room for original design to meet varying conditions.

**Mill and Joisted Construction.**—No distinction is made between these. They are permitted in buildings up to 75 feet or 6 stories in height, except that hotels, schools, theatres, hospitals, lodging houses and jails may not be over 35 feet in height if of joisted or mill construction.

**Frame Construction.**—Not permitted in fire limits except sheds open one side, which may not be over 15 feet high, and small buildings not over 150 square feet and 8 feet high.

**Heights.**—Buildings over 6 stories or 75 feet must be fireproof. No limits to height of fireproof buildings. Frames such as are permitted must not be over 15 feet high inside fire limits; frames outside fire limits may be 40 feet high. Tenements must not exceed in height one and one-half times the width of the street.

**Floor Areas.**—No limits in fireproof buildings. No permitted frames may exceed 2,500 square feet except by permission of Bureau. Other buildings limited to 8,000 square feet except as follows: If fronting on three streets, they may be 22,000 square feet; on corner of

two streets, 12,500; and extending from street to street, 15,700.

**Roofs and Roof Openings.**—Skylights more than 9 square feet in area must be set in iron frames. Fireproof roofs must contain skylights equivalent in area to at last 1/50 their superficial area. Mansards having a pitch of over 60 degrees to be fireproof except on frame buildings and dwellings not over three stories or 40 feet in height. Cornices must be fireproof and independent of any woodwork; existing wooden cornices if damaged one-half must be replaced fireproof.

**Thickness of Walls.**—Provisions fairly satisfactory except that 8-inch walls are permitted in smaller buildings of certain classes.

**Parapets.**—Required on all exterior and division or party walls over fifteen feet high, except where such walls are to be finished with cornices, gutters or crown mouldings; to be coped with stone, terra cotta or cast iron; to be not less than 8 inches thick and 2 feet high and must be not less than 12 inches thick and 3 feet high on warehouses, stores, factories or other buildings used for commercial or manufacturing purposes.

**Exposed Windows.**—Every building over two stories high, except dwellings, hotels, schools and churches to have fireproof shutters on every exterior opening above first floor except where separated more than 30 feet from any other building.

**Openings in Division and Party Walls.**—At the option of the Bureau of Buildings, which requires standard fire-doors between all buildings of large areas.

**Flues.**—Requirements for thickness of flue walls, linings, sectional areas, etc., generally satisfactory. Four inch flue walls allowed, but all brick flues must be lined.

**Furnace Settings.**—The provisions with respect to these are very good and with a few changes would coincide with those in the Building Code of the National Board. They have resulted in greatly improved conditions.

**Floor Openings.**—Unenclosed freight elevators in existing buildings must be trapped at floors. Elevator, hoist and dumbwaiter shafts in new non-fireproof buildings must be fireproof with fireproof doors at all openings. Elevator shafts in existing and new hotels must be fireproof and enclosed. Light and vent shafts must be of brick in buildings erected hereafter. Floor lights in new buildings must be set in iron frame with wire screen in or under the glass. No provisions for the trapping or enclosure of stairs.

**Floor Beams.**—Requirements generally satisfactory; only 4 inches of masonry required between ends of beams on opposite sides of walls.

**Standpipes and Automatic Sprinklers.**—Buildings over 85 and less than 150 feet high to have 4 inch standpipe; if over 150 feet to have 6 inch standpipe; standpipes to have steamer connections and hose attached on each floor, placed near stairs. Business and manufacturing buildings to have 2½ inch perforated pipe on ceiling of all floors below first floor, or, in lieu of these, automatic sprinklers. Stage, dressing-rooms and other hazardous portions of theatres to have automatic sprinklers, and stage and auditorium to have standpipes.

**Fire Escapes.**—Mercantile buildings over three stories high, office buildings five stories or over, and dwellings occupied by three or more families, to be equipped with sufficient fire escapes of stair and balcony type, kept in good repair, properly painted and free from encumbrances. The Bureau of Buildings controls the enforcement of these requirements on mercantile and office buildings, while the Tenement House Department has the supervision of tenement and apartment houses. Daily inspections of buildings and fire escapes are made by both Bureaus; the police and firemen are also required to report any encumbrances on fire escapes in their districts. Penalty, $10 fine and ten days' imprisonment.

**Fire Limits.**—Erection of frame structures is not permitted and existing frame buildings more than two stories high not to be altered or raised, or used as a factory, warehouse or stable within the following described limits:

*Manhattan.*—Commencing at the Battery, thence along pier headline of North River to 100 feet north of One Hundred and Sixty-fifth street, 10 feet west of Broadway to bulkhead line of Harlem River, along said line to Bronx Kills and along East River passing to the east of Blackwell's Island to point of starting.

*Bronx.*—Bulkhead line of Harlem River, One Hundred and Sixty-first street, Sheridan avenue, One Hundred and Sixty-first street, Park avenue, Webster avenue, One Hundred and Seventy-seventh street, Third avenue, Crotona Park, Prospect avenue, Westchester avenue, Robbins avenue, Port Morris Branch Railroad, East River, Bronx Mills, to point of starting.

**Former Laws.**—The first building law of which there is a record was passed in 1766; this required that none but brick houses be built in the district south of the present Duane street.

Until 1860 public supervision of buildings was exercised by fire wardens. In this year a building code was adopted and a Department of Buildings created to enforce them. Fire limits were also established at Fifty-second street, extending from river to river. The

principal regulations of this code were as follows:

No party wall to be less than 12 inches thick; 4 inches of masonry between ends of floor beams; parapet walls to extend 12 inches above roof and coped with iron or stone; 8 inch flue walls; no single flue pipe allowed unless protected by one inch of plaster of paris, and no part of flue to rest on woodwork, and no pipe to be nearer woodwork than two inches; noncombustible cornices on buildings over 38 feet high; buildings other than dwellings more than two stories high to have fireproof metal shutters, at all openings above first floor, not on a street; dwellings for more than three families to have fire escapes.

Except that fire limits were extended to Eighty-sixth street in 1866, no material change in the code was made until 1871, when a new law was passed by legislature.

Fire protective features adopted at this time required that first and lower stairs of tenement houses be constructed fireproof; floor openings for elevators to have trap-doors; skylights to have metal frames; fire escapes required on mercantile, factory, office and hotel buildings, and encumbrances were prohibited; thickness of walls practically the same as now required.

In 1880 the Department of Buildings was merged into the fire department as a bureau therein. The new law of 1885 marked an important turning point in the character of construction in Manhattan. Its main changes were as follows:

1. The height of non-fireproof buildings was limited to 75 feet. The importance of this law may be judged from the fact, that during the few years previous to its adoption light joisted construction was being pushed higher and higher until especially in the case of hotels and apartments the dangers attracted general attention. Much of the most hazardous construction now in the district dates from the period just anterior to 1885.

2. The new restrictions on tenement house construction while far from adequate put a check upon many dangerous tendencies.

3. All elevator shafts in new buildings were required to be enclosed in fireproof walls carried three feet above roof and covered with fireproof skylight. Parapet walls to be carried two feet above roof.

4. Up to 1885, theatre construction had been growing more and more dangerous, and the laws of 1885, while not sufficiently drastic, still worked a revolution in theatre construction. Generally speaking, the flimsy theatre construction in Manhattan is now found only in the theatres built or begun previous to 1885. The new rules required substantially fireproof construction in the major part of the theatres. Proscenium wall was required to be a fire wall with an asbestos curtain and all other openings protected. Fireproof floors were required for auditorium and parts of stage equipment, and all of auditorium ceilings were to be of fireproof materials. All lathing was required to be of metal and practically all interior walls and partitions were required to be of fireproof materials. Important regulations affecting the safety of the audience were also made. Standpipe and other important fire appliances were prescribed and automatic sprinklers were required over stage, and the methods of heating and lighting were regulated.

Mention should be made of the valuable service rendered by the New York Board of Fire Underwriters in remedying the defects of the existing laws at various periods. Especially previous to the law of 1885 it may be said that the underwriters' rules and rating schedules were the main influence in checking bad practices and in remedying dangerous conditions permitted by the law. This was notably the case in the matter of flues and the settings of furnaces for heating and industrial purposes. In the matter of providing at least a measure of protection for floor openings and open communication permitted by earlier laws, in mercantile and manufacturing buildings, the local Board also rendered valuable services.

In 1892 the supervision of building construction was taken out of the hands of the fire department, and the Bureau of Buildings was organized as an independent department of the city.

With but slight changes the laws remained in force until 1901, when the provisions of the Revised City Charter went into effect.

**Proposed Laws.**—Representatives of a number of trade and professional organizations held a meeting on August 1, 1905, and drafted a resolution stating that certain changes in the building laws were desirable, and petitioning for the appointment of a committee to consider same. This resolution was forwarded to the Board of Aldermen for action.

**Enforcement.**—An inspection of a large number of buildings under construction was made by National Board engineers, and it was found that the regulations are being enforced in the higher class of structures, but that in the construction of cheap tenements and apartments for speculative purposes there was much laxity in the enforcement of the law. A flagrant instance of such laxity came to light on March 19 and 20, 1905, when there was a collapse of 23 apartment houses under construction, due to defective materials and workmanship, permitted by inefficient or unconscientious inspection and so reported by an expert investigation committee. The findings of this committee were borne out by an inspection of

the ruins made by the engineers of the National Board.

The engineering staff of the Bureau is competent and endeavoring to enforce rigid compliance with the regulations, but its good work is to a large extent nullified by inspectors inefficient or otherwise failing to perform their duties. Shortly after and as a result of the collapse of the apartment houses mentioned, four of the inspectors were discharged and the authorities are apparently anxious to remove incompetent or dishonest inspectors where evidence to this effect is presented.

**LOCAL CONDITIONS.**—Practically the first supervision exercised by the municipality over building construction was in 1860, when the city began to extend its limits. The advent of the passenger elevator, with its influence on types and methods of construction, and of the tenement house, led the city to assume control. Owing to the comparative recentness of this control, older parts of the city embody objectionable structural features such as peaked roofs in rows, mansards, deficient walls and timber interiors where more fire-resistive types should prevail. One inheritance is the building with the cast-iron front and light joisted interior seen along lower Broadway and in the territory nearby east and west. From 1879 to 1900 the prevailing type of tenement was the discreditable "double-decker" or "dumb-bell" tenement house. These houses were usually from five to seven stories in height, each occupying 80 per cent. of a 25 by 100 foot lot, with a 2 by 50 foot so-called "air-shaft" on each side. These air-shafts were not only the source of sanitary evils, but acted as flues in case of fire. The interiors were often flimsy also. Conditions were improved and some of the evils cited checked by the Tenement House Act of 1901, although other classes of buildings continued to spring up with many departures from modern practice.

There is very little frame construction in Manhattan. A few frames exist on the lower west side, in the wholesale grocery district, in the lower east side tenement district, in the residence district in Harlem and in Manhattan Valley. Except for a cluster in Manhattan Valley, the frames are sporadic and unimportant in considering the city as a whole. The business section of the Bronx is practically all brick, but the construction in this borough shades off rapidly into frame.

Fireproof construction of the structural iron and brick-arched floor type dates mainly from 1871, the time of the Chicago fire, when the public felt it needed a more fire-resistive construction than brick walls with tinder interiors. The present skeleton type was a development which appeared a few years later. At the present time there are about 1,500 fireproof buildings in the two boroughs. Many others are in the course of erection. The recent collapse of an apartment house under construction brought out the fact that the laws permitted flange-connected cast iron in high and narrow skeleton framing to a degree not approved by good engineering principles and unusual in other cities. Concrete steel construction did not receive the sanction of the Building Department until the middle of 1903, and then in a very conservative manner under rigid specifications which the building trades and professional organizations are endeavoring to have modified.

Besides the fireproof buildings there are 338 risks with complete and partial automatic sprinkler equipments, and 2,650 premises have pneumatic or electrical types of automatic fire-alarm signal installations.

In the older portions of the city streets are very narrow, and unprotected vertical and horizontal openings prevalent. Excess-height or overhanging openings, particularly, are unprotected throughout the city. In the newer and more regularly laid out sections, long hollow-square blocks are the rule. These in many cases are built up with interior structures, especially in sections devoted to cheaper flats and tenements.

**CONCLUSIONS.**—The building laws are extensive and cover most features of building construction. They are, however, inadequate in many particulars, failing to meet the requirements of a metropolis developing under special conditions of growth. The provisions relative to structural iron and steel work are inelastic and those pertaining to concrete steel do not wholly recognize the advance in the art. Cast-iron columns united end to end at each floor by flanges are permitted without height restriction. No distinction is made between private dwellings and dwellings for apartment purposes or between joisted and mill construction. Heights and areas are not restricted in accordance with modern views. Nor are the provisions adequate with respect to protection on wall and floor openings, thickness of walls in certain types and thickness of masonry demanded between ends of floor beams on opposite sides of walls. The responsibility for enforcing the fire-escape ordinances is divided between several departments, and the fire limits could be extended to advantage.

Many objectionable local conditions exist due to past laws or absence of laws and to the non-enforcement of such wise provisions as may have existed, and the present enforcement of the laws is far from satisfactory. The department in The Bronx is aggressive in some

respects, but that in Manhattan has shown an unfamiliarity with conditions which, to say the least, should be improved. Violations of the law are still occurring in buildings of the speculative type, although the supervision of buildings of superior construction is good. The incompetency or inefficiency due to other causes, of individuals in the department has been demonstrated beyond dispute, and while direct culpability may not attach to the administrative heads of the departments, it is certain that much responsibility rests upon them for undesirable conditions.

## EXPLOSIVES AND INFLAMMABLES.

**ORGANIZATION.— Supervision.—** Supervision and control of explosives and inflammables are in the hands of the Municipal Explosives Commission organized May, 1892, and consisting of the fire commissioner, *ex-officio*, chairman, and four members appointed by the Mayor and holding office at his pleasure. No special qualifications are required except that one member must be a chemist. Present Commission mixed politically. Meetings are held weekly at fire headquarters, each member being allowed $10 for meeting attended, except the fire commissioner.

**Personnel.**—Mr. Nicholas J. Hayes, fire commissioner, *ex-officio*, chairman; Mr. Franz S. Wolf, secretary; Mr. William Montgomery, Mr. John Sherry and Mr. Abraham Piser. One vacancy exists, there being no chemist on the Commission. Members are not interested in any business contemplated by the ordinances.

**Executive.**—The Bureau of Combustibles is charged with the execution and enforcement of the laws. It maintains an office at fire department headquarters. Mr. George Murray, chief inspector, is the active manager. He was appointed May, 1895, by the fire commissioner, to hold office during good behavior, having had ten years' previous experience as a manufacturer of high explosives.

The inspection force consists of fourteen inspectors chosen by civil service examination. They are given special training by the chief inspector before being assigned to duty. Future candidates for inspectorships will be required to have a knowledge of insurance chemistry. Four inspectors receive a salary of $1,200 and ten $1,050 each. Fourteen firemen, twelve of whom are located in The Bronx, are also attached to this Bureau, devoting their time to inspection work.

**Inspections.**—The inspectors make surveys of all premises applying for license and investigate all complaints of nuisances or violations reported by firemen. The firemen attached to the Bureau watch blasting operations daily. Owing to the small force, systematic reinspection of premises is out of the question, but an effort is made to visit premises suspected of being specially hazardous at least once or twice a year.

Officers of fire department companies make irregular inspections in their districts, noting among other matters the storage of combustibles and seeing that proper licenses are held where required. Firemen also serve notices of violations upon offenders. Records of surveys, notices, etc., are kept satisfactorily.

**LAWS AND REGULATIONS. — General.**—Licenses are required from the Explosives Commission to manufacture, handle or sell any explosive or inflammable substances in the two boroughs. All money received by the Explosives Commission is turned over to the Firemen's Relief and Pension Fund. Before licenses become operative, those designated to load holes, discharge explosives, transport explosives and inflammables by wagon, or take care of magazines, and warehousemen, shall pass an examination before the Commission. Wagons for transportation purposes are required to be built according to specifications named by the Commission. They must also have "Powder Wagon" painted on their exterior, avoid crowded streets and carry no more than 1,000 pounds of explosives at any one time. Such explosives must be packed in strong cases stamped with the name and brand of the manufacturers and be in the care of certificate holder. Nitro-glycerine, except in the U. S. pharmacopœia solution, may not be transported through the streets.

A digest of the principal provisions in the laws follows:

**Magazines.**—Storage is permitted on magazine boats anchored at points designated by the U. S. Government. Magazines for blasting contractors are of three classes: the first containing more than 100 pounds; the second, between 25 and 100 pounds; and the third, not more than 25 pounds. All must be built according to a prescribed standard and have a copy of the permit attached. They must also be in charge of properly authorized persons and be inspected regularly by an inspector from the Bureau of Combustibles.

**Explosives in Vessels.**—Vessels with more than 28 pounds of any explosive may not approach nearer than 300 yards any pier line without permit, such permit to be for no longer than 48 hours. They must display a red flag five feet square at the masthead and permit no smoking on deck. Vessels may not carry more than 5,000 pounds of explosives within 1,000 feet of any pier line and may not carry exploders at any time. No vessel carry-

ing explosives may land except for immediate distribution and then under proper orders.

**Gunpowder.**—Black and smokeless powder on magazine boat not to exceed 125 tons. Retail dealers may not carry exceeding 14 pounds and such supply must be kept in metal receptacle marked "Powder" located not more than ten feet from the entrance. Dealers must also display signs reading: "Licensed to sell gunpowder." No permits are granted for frame buildings or for any premises containing other explosives. The sale of black sporting powder is prohibited except to military organizations or firms engaged in shell loading, etc., and then in quantities not exceeding ten pounds. Violation of the ordinance constitutes a misdemeanor, punishable by a fine of $1,000 or imprisonment from one to five years, or both.

**Dynamite, Nitro Glycerine and its Compounds.**—Maximum amount to be stored on any one magazine boat, 30 tons. Only approved brands permitted, packed in strong wooden cases containing not more than 50 pounds in a single package with liquid-proof lining and marked, "Explosive—Dangerous."

Applicants for licenses to handle high explosives for blasting must file a bond. A bond of $5,000 is required for using 50 pounds or less a day. Vendors of blasting explosives are required to submit a verified itemized weekly statement of sales. Blasting charges may be prepared only as prescribed and may be fired by electrical apparatus only. The thawing of dynamite is prohibited except by approved methods. Cartridges while being capped to be removed from magazine at least 20 feet and blasts must be properly covered to prevent debris from flying. Warning by means of red flags must also be given at least three minutes in advance of blast.

**Electric Fuses, Detonators and Blasting Caps.**—Manufacture prohibited in both boroughs. Shipping cases may contain no more than 5,000 electric fuses and must bear the words, "Electric exploders; handle with care." No more than 10,000 electric fuses, detonators or caps may be stored and then in iron receptacles with iron covers and wheels; of the amount, no more than 2,000 shall be fuses. As much as 25,000 fuses, detonators or caps in packing cases may be authorized temporarily for shipment to points outside the city.

**Fireworks.**—The manufacture of any composition to be used in obtaining effects by combustion, explosion or detonation is prohibited in both boroughs. Wholesale dealers must give a bond of $5,000, pay $20 annual license and submit weekly statement of sales within the city. No permit is granted if part of premises is occupied as a dwelling or for the storage of explosives or inflammable materials, or if premises are within 50 feet of another having a permit. Dealers must have 32 gallons of water in buckets ready for immediate use. Storage limited to 500 boxes of each size and kind of crackers, except that 3,000 boxes of small Chinese crackers may be kept. Torpedoes and paper caps limited to 500 cases.

In addition to the above, from June 10 to July 10, $500 worth may be stored provided a special watchman is maintained in front of premises. Articles containing chlorate of potash or picrates prohibited. The entire amount of fireworks permitted on any retail license shall not exceed $500 in value. Annual retail license fee, $5; special retail license to sell only torpedo caps and firecrackers. Discharge of fireworks prohibited except on Independence Day and then not to exceed $25 worth without a permit.

**Nitrates of Cellulose.**—No material having a nitrate of cellulose base and a volatile combustible as its solvent may be manufactured in the city. Maximum storage in any one place without license, 500 pounds. Fee, $2.

**Calcium Carbide and Acetylene.**—Storage of calcium carbide, by consumers, in other than generator building is prohibited. Calcium carbide must be kept in hermetically sealed iron receptacle marked "Calcium Carbide; Dangerous if not Kept Dry." No single package may contain over 100 pounds. The use or storage of liquid acetylene is absolutely prohibited. Acetylene apparatus fitted with one burner only and 20 pounds of carbide therefor are exempt. Generators must be in detached fireproof building with approved ventilation. Acetylene dissolved in acetone is permitted under special license of $50 in steel cylinders of approved design, at not exceeding 300 pounds pressure.

**Ammunition.**—The maximum amounts permitted are 300,000 loaded paper shot shells; 2,500,000 metallic cartridges for pistols; 500,000 metallic cartridges for rifles; 2,000,000 primers for central fire ammunition; and 6,000,000 percussion caps or primers. If loaded paper shot shells are not stored on the premises, the amount of pistol cartridges may be increased to 4,500,000. Calibres shall not be larger than .45 inch.

**Drugs and Chemicals.**—It is absolutely prohibited to have on sale or storage in wholesale or retail drug stores any of the following substances: Colored fire or flashlight powders in any form; liquid acetylene; acetylide of copper; fulminate of mercury; fulminating gold and silver, or any other fulminate or fulminating compound; guncotton; nitroglycerine, except in official U. S. pharmacopœia solution; chloride of nitrogen, or any amide or amine explosive; gunpowder in any form; cymogene or any volatile product of petroleum or coal tar having a boiling point lower than 60 de-

grees F.; chlorate of potash, in admixture with organic substances or with phosphorus or sulphur, provided that this restriction shall not apply to the manufacture or storage of tablets of chlorate of potash made, kept and intended for use solely for medicinal purposes.

Packing rooms to be remote from large stocks and kept as free as possible from accumulation of combustible materials. Chemicals not to be stored in close proximity if one could increase the energy of decomposition of the other, or if they could react upon one another and become explosive. Liquid chemicals to be stored with safety catch basins or trays. Nitric acid not to be stored except on brick, concrete or asphalt floors. Liquids for cleaning purposes, having a boiling point less than 150 degrees F., not to be dispensed in retail stores, unless in four-ounce bottles, and total stock not to exceed five gallons.

Maximum quantities of different chemicals for all conditions of storage are prescribed in an extensive tabulation. Should any owner keep a quantity of explosives in excess of that allowed in his license, or permit his premises to remain in an untidy condition, he shall forfeit his license.

Wholesale chemical storage to be in charge of warehouseman holding certificate of fitness granted by the Commission. Chemical factories and technical establishments require a license fee of $10. Wholesale license, $10; retail, $2.

**Matches.**—Storage room to have brick walls all sides, lighted by gas or electricity; each floor to be provided with fire extinguishers. Each box to have "Licensed Match" and name appear on it, and not to contain more than 1,000 well made matches with independent heads and strong splints.

Wholesale license to carry 3,500 gross of boxes in original packages, $5 per year. Violations of law, $50 fine, or revocation of license, or both.

**Combustible Fibres.—(Cotton, Hemp, Jute, Straw, Shavings, etc.).**—No finely divided vegetable fibre or cotton, excelsior, flax, hay, hemp, husks, jute, oakum, rays, rushes, sawdust, shavings, straw, broom-corn, etc., to be stored or manufactured in quantity greater than 20 tons, unless kept in brick building more than 10 feet away from any hotel, school, dwelling, boarding or tenement house.

**Oils and Naphthas.**—The provisions covering these are very extensive and specific. They are also in accord with approved practices in most particulars.

**LOCAL CONDITIONS.**—An inspection of all premises storing explosives and combustibles was made, and it was noticed that the handling and storage of higher explosives were in conformity with the regulations. Large supply magazines are maintained in magazine boats anchored a safe distance from shore. In a number of automobile garages, naval supply and chemical establishments in various parts of the two boroughs, it was found that naphtha, gasoline, calcium carbide and dangerous chemicals were stored in excess of license allowance, or were improperly handled, and many of these premises were hazardous by reason of untidiness. A manufacturing druggist in The Bronx had 200 gallons of naphtha stored in four metal cans standing inside of laboratory, and drawn off by gravity in open measures. The largest storage noted was the Standard Oil warehouse at Forty-sixth street and Eleventh avenue, where manner of storage was satisfactory, but premises are exposed by stables and frame structures. Many of the oil stores in the southeast end of the city and along the west side are in an untidy and hazardous condition.

The present force of the Bureau of Combustibles is too small to handle the situation.

**CONCLUSIONS.**—The laws and regulations are comprehensive, specific and well designed, needing but slight revision to enable them to handle modern conditions, and such revision is contemplated. The Bureau of Combustibles, which is charged with the enforcement of the laws, is efficient and energetic, but short-handed, with the result that many hazardous conditions exist in various parts of the city to the discredit of the municipality and constituting a public menace.

## ELECTRICITY.

**ORGANIZATION AND CONTROL.—General.**—The New York City Electrical Bureau is a branch of the Department of Water Supply, Gas and Electricity, under the general supervision of Commissioner John T. Oakley and Deputy Commissioner Frank J. Goodwin. The Bureau is in direct charge of the electrical engineer, who is assisted by 23 inspectors and 15 other employees, all under civil service rules.

The New York Board of Fire Underwriters maintains 18 inspectors under the direction of a chief inspector and the superintendent, 14 of the inspectors being assigned to duty in Manhattan and The Bronx.

**Personnel.**—The electrical engineer, Mr. Frank E. Brown, has had a varied electrical experience and was appointed to his present position in 1902.

Mr. C. F. Boynton, the chief inspector, was with the Manhattan Electric Co. for seven years, being for two years assistant superintendent. He was then electrical inspector in

the fire department for three years until appointed to his present position in 1898.

The electrical inspections of the New York Board of Fire Underwriters are under the charge of Mr. W. A. Anderson, superintendent, and Mr. J. C. Forsyth, chief inspector. The latter is in direct charge of electrical inspectors. He is a technical graduate with wide experience. The inspectors are selected from the ranks of practical wire-men.

**Inspections.**—The city inspectors devote their attention to new work, enforcing the city code, but in 1903 numerous reinspections were made of old work in the "uptown" districts, resulting in the improvement of many installations. Inspections of each equipment are made during the work of installation at frequent intervals and after completion of work. Certificates of approval are issued by the city upon the satisfactory completion of work. Records are complete and well kept, a card system being used. The inspections made are rigid unless the contractor is in good repute, in which case the installation is not so closely supervised. No fees are charged for inspections.

The insurance inspectors examine work during installation and fixtures and service installations after completion, enforcing the National Code. All inside work is inspected before plaster is put on. No concealed knob and tube work is allowed. Certificates are issued for temporary work, for permanent wiring and for fixtures, records being kept of all inspections and certificates. Electrical contractors in good repute are given a freer hand than others whose work is rigidly examined. Two inspectors have been detailed especially on old work. During the past year, they caused improvements costing $200,000. The Board made a total of 62,019 electrical inspections during 1904, three-quarters of these being in Manhattan and The Bronx. Fees are charged by the Board for electrical inspections.

**LAWS, ORDINANCES AND REGULATIONS.**—By various acts of the legislature, the Department of Water Supply, Gas and Electricity is empowered to supervise and control all electrical installations, subways and circuits. The city electrical code has not yet been adopted by ordinance, but its requirements have been incorporated in the rules and regulations of the Bureau of Electricity since 1898. It is based on the National Electrical Code, with several restrictions, such as the prohibition of all knob and tube work and many rules advisory in the National Code are made mandatory in the city code. Additional rules are provided governing heating and cooking appliances, circular loom and armored cable, signs, floor receptacles, etc. It is unlawful to supply current to any installation until the department shall have issued its certificate of approval. Electricians are not examined or licensed. Wires are required to be placed underground wherever subways have been completed, and all wires south of Chambers street have been ordered underground.

**INSIDE WORK.**—In August and September, 1905, 971 installations were inspected by National Board engineers in 166 city blocks taken at random throughout Manhattan and The Bronx, but mostly in the mercantile and hazardous sections.

New wiring was carefully inspected and found to conform to the National Electrical Code, nearly all defects being found in work installed before 1902, and before the present municipal officers took charge of electrical supervision.

Number of installations inspected, 971; number of installations found defective, 763; number of separate defects, 2,320, or less than three violations per installation inspected.

The defects observed were as follows:

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| Arc lamps not out of reach or badly hung | 2 |
| Arc lamps not fused individually | 4 |
| Branch circuits more than 660 watts energy | 15 |
| Branch fuse blocks not properly connected | 2 |
| Broken switch | 32 |
| Broken cleats or rosettes | 16 |
| Broken fixtures | 6 |
| Cabinets not properly lined with asbestos, or doors broken or gone | 128 |
| Current for motor or light from trolley circuit | 2 |
| Dead wires in building | 22 |
| Door switch in poor condition | 3 |
| Electrical figures or musical instruments in bad condition | 2 |
| Elevator wiring poor, or improperly installed | 5 |
| Fixtures not rigidly attached | 1 |
| Flexible cord not standard | 227 |
| Flexible cords supporting clusters | 18 |
| Flexible cords too long, or used other than as a pendant | 62 |
| Flush switches not enclosed in metal boxes | 1 |
| Fuses two heavy | 38 |
| Gas meters and electric switches, fuses or circuit breakers too close together | 2 |
| High and low tension wires or signaling wires too close together | 4 |
| Improper fuse block, or none, on fan or motor circuit | 14 |
| Improper switch, or none, at entrance, or switch improperly located | 8 |
| Improper switch, or none, on fan or motor circuit | 28 |
| Iron conduits not plugged at outlets | 2 |
| Joints not soldered or taped, or badly made | 17 |
| Joints under canopies not soldered | 1 |
| Knife switch not inverted or improperly located | 4 |
| Lamp sockets not bushed or broken | 22 |
| Lamps too close to combustible material, or cords in show window | 55 |
| Link fuses, exposed location | 321 |
| No bracket or drip loops at entrance | 18 |
| No canopy insulator between fixture and metal ceiling or pipe | 42 |

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|---|---|
| No globe or wire netting around lamp | 1 |
| No fuse block at entrance, or improperly located | 4 |
| No spark arrester on arc lamp | 9 |
| Outside terminals in bad shape | 4 |
| Pendants ornamented with tissue paper, gauze, cloth, etc | 35 |
| Plug cutouts without caps | 82 |
| Plug or cartridge fuse block bridged with string fuse or wire | 21 |
| Poor work around meter | 10 |
| Rheostats boxed or out of sight of motor, or in wooden case | 5 |
| Service discontinued, but live wires attached to building | 3 |
| Solid wires used as conductors to movable lamps | 17 |
| Starting box improperly mounted | 4 |
| Switchboard and wires in bad condition; trash behind board | 61 |
| Switches or fuses overloaded or in bad condition | 12 |
| Switch or fuse block in contact with, or too close to, inflammable material | 19 |
| Switches not easily accessible on heater or sad iron | 1 |
| System grounded | 6 |
| Too many lights dependent on final fuse block | 6 |
| Transformer inside building, or attached to frame | 9 |
| Tubes not taped to wires | 26 |
| Unapproved fuse blocks at entrance, or block in bad shape or needing covers | 107 |
| Unapproved snap switch | 3 |
| Unapproved sockets or rosettes | 15 |
| Unapproved wire | 53 |
| Wires at entrance bushed with unapproved tube, or not at all | 14 |
| Wires against or too close to grounded pipe, or improperly protected | 154 |
| Wires against woodwork or wall paper | 64 |
| Wires attached with wooden cleats, staples or nails | 69 |
| Wires in contact with foreign metallic bodies | 80 |
| Wires loosely supported, or not at sufficiently frequent intervals | 71 |
| Wires laid in plaster | 1 |
| Wires too small for circuit carried | 10 |
| Wires not protected where liable to mechanical injury | 40 |
| Wires of opposite polarity in unapproved conduit | 3 |
| Wires run through roof | 1 |
| Wires of opposite polarity in contact or too close together | 85 |
| Weatherproof wires in conduit or damp place | 2 |
| Wires not entering conduit properly at change from concealed knob and tube to conduit work | 2 |
| Wires not bushed or bushed improperly | 23 |
| Wire or insulation not standard on portable heater | 2 |
| 110-volt fuses and blocks on 220-volt circuit | 2 |
| 110-volt switch on 220-volt circuit | 4 |

From the above table it will be seen that while many of the defects were due to original installation, most of them have probably crept in since. Both the original and acquired defects are of great variety and about 20 per cent. may be classed as hazardous. Many old installations, however, had been improved and were found to be in excellent condition. Much of this improvement is due to the efforts of the Bureau of Surveys of the New York Board of Fire Underwriters, which has, in the last two years, taken up the inspection of old equipments.

**OUTSIDE WORK.**—Most of the underground wires in Manhattan, other than those for street railway purposes, are carried in the conduits of either the Consolidated Telegraph & Electric Subway Company or of the Empire City Subway Company, the former being the older installation. Its ducts were originally occupied by telegraph, telephone and fire alarm circuits as well as wires carrying light and power high tension currents. The ducts of the Empire City Subway Company were subsequently provided for the accommodation of low tension telegraph, telephone and similar signaling circuits, leaving the ducts of the Consolidated Company primarily for the high tension circuits. The high tension subways are still utilized in many places for fire alarm and low tension signaling wires, and both high and low tension currents are brought to many manholes in common. It is reported that fires have been caused by crosses between high and low tension circuits.

The New York Edison Company supplies municipal and commercial light and power. It maintains 6,600 volt A. C. circuits between the main and sub-stations, where current is both converted into 120-240 volts D. C. and transformed to 120-240 volts A. C. Arc lighting is on the same D. C. circuits. Incandescent lighting is by 120-240 volts D. C. circuits. Its wires in Manhattan are underground.

The United Electric Light & Power Co. supplies municipal and commercial light and power. It maintains 2,500 volts A. C. circuits, transformed into 105-210 volts A. C. circuits. Arc lighting is by 210 volts circuits; incandescent lighting and power is by 105-210 volts A. C. circuits. Its wires in Manhattan are underground, except a few beyond the fire limits at the upper end of the island.

The Bronx Gas & Electric Co. supplies municipal and commercial light and power. Series arc lighting is by 4,000 volts D. C. circuits; incandescent by 110 volts A. C., and power by 220 volts A. C. transformed from 2,200 volts A. C. Its wires are overhead.

The Westchester Lighting Co. (Bronx) supplies municipal and commercial light and power from 2,200 volts A. C. circuits transformed to 104-208 volts A. C. for incandescent lights and power, and 208 volts A. C. for arc lights. Its wires are overhead.

About 12 per cent. of street arc lights are of series type on 4,000 volts D. C. circuits, the rest being multiple arcs on 208-240 volts circuits.

The Interborough Rapid Transit Co. (elevated and subway) generates power for its 78 miles of railway (third rail system) at 11,000 volts A. C., converted at sub-stations to 600 volts D. C. grounded circuits.

The New York City Railway Co. (Metropolitan Street Railway) generates power for its 210 miles of underground trolley lines in

Manhattan at 6,600 volts A. C., converted to 550 volts D. C., all-metallic insulated circuits. This company sells power at 6,600 volts A. C. to the Union Railway Co., which converts it at its sub-station to 550 volts D. C., and operates overhead trolley lines in all the principal streets of The Bronx.

The New York Telephone Co. has all its trunk lines underground in Manhattan and the mercantile district of The Bronx. Many distributing cables run on fences in block interiors and above One Hundred and Twentieth street distributing wires are strung on poles and houses. In The Bronx distributing wires are all overhead. Fuses are provided at stations and at subscriber's premises.

The Western Union Telegraph Co. and the Postal Telegraph-Cable Co. operate telegraph services; trunk lines underground, except some cables suspended from elevated railway structure. Wires generally enter buildings underground. Fuses are provided at terminals of both underground and overhead lines.

The American District Telegraph Co. and the Postal Telegraph-Cable Co. operate messenger call service; trunk lines underground, some distributing wires overhead in underground districts. Fuses provided at stations.

The Manhattan Fire Alarm Co. maintains an auxiliary fire alarm system, having its subscribers' premises connected with the nearest street fire alarm box. About 33 per cent. of these connections are underground, the rest being strung overhead from buildings to alarm box posts. No fuses are provided between subscribers' boxes and street boxes.

The Automatic Fire Alarm Co. operates a central station alarm system. Most of its wires are underground, a few distributors being overhead. All circuits are provided at station with fuses and lightning arresters.

The Consolidated Fire Alarm Co. (Pneumatic Fire Alarm Co.) operates a central station alarm system. Eighty per cent. of its wires are underground. All circuits are protected at station by fuses and lightning arresters.

The Special Fire Alarm Electrical Signal Co. operates a central station alarm system; 80 per cent. of its wires are underground. All circuits are fused at station and at subscribers' premises.

The Holmes Electric Protective Co. operates a central station watch system with five central stations. Trunk lines underground; some distributors overhead. All circuits protected at stations only by fuses.

The Mercantile Electric Co. operates a central station burglar alarm system. All wires are underground.

Fire alarm wires are nearly all underground in lower Manhattan except a cable suspended from the Third avenue elevated railway structure. Trunk lines in business district of The Bronx are underground; all others overhead.

Police telephone system is operated by the New York Telephone Co. under the same conditions as its own lines.

There is but one high potential overhead circuit in Manhattan, about ¾ mile of trolley in One Hundred and Thirty-fifth street. All low tension lines are underground except a line of telephone distributing wires about three miles long on Amsterdam avenue above One Hundred and Fourteenth street, about two miles in cross streets in same locality, and telegraph and fire alarm cables suspended from the elevated railway structure. A few distributing poles for telephone wires are used in residential districts above One Hundred and Twentieth street, but in general these distribute from cables along fences in centers of blocks. A few signal wires are strung from roof to roof in mercantile districts. Electric light and power wires with few exceptions enter buildings underground. In the mercantile section of The Bronx trunk lines of signaling systems are underground. Nearly all other wires are overhead, including 4,000 volts series arc and 2,200 volts A. C. circuits. These high potential wires are not on same poles with signal wires. Transformers are located in basements in underground district; elsewhere, on poles.

The overhead wires obstruct buildings in some cases, notably in Third avenue, East One Hundred and Thirty-eighth street and Willis avenue—important thoroughfares of The Bronx.

**ELECTROLYSIS.**—Little trouble has been experienced in Manhattan from electrolysis, but in The Bronx some damage has occurred to gas and water pipes. Prof. G. F. Sever, consulting engineer of the Department of Water Supply, Gas and Electricity, has made a few tests in both boroughs, but the results were never collated. They showed, however, that pipes were only slightly positive to the ground.

The Interborough Rapid Transit Company has made tests on its system, but the results were not obtainable. Some leakage has occurred from the elevated structure, but it is not known to have caused damage. Other companies report no trouble from leakage or electrolysis.

**CONCLUSIONS.**—Both the municipal and underwriting inspection departments are well organized, and are doing good work. An inspection by National Board engineers of nearly 1,000 equipments brought to light no cases of incompetency. The situation with respect

to older work, however, reveals the need of more speedy reinspection. The municipal code is excellent, being practically the same as the National Code, and well enforced on new work, the underwriters enforcing the National Code equally well. Conditions with respect to outside wiring are generally satisfactory. Wiring is generally underground in Manhattan, but high potential overhead circuits are frequent in The Bronx. Electrolysis is not appreciably felt.

## CONGESTED VALUE DISTRICT.

In a broad sense this may be said to comprise the entire island of Manhattan, although there is a territory which may be termed relatively a high value district. This district, however, exceeds the surrounding territory so little in value and is so lacking in homogeneity, comprising, as it does, parts and scraps of districts legitimately definable by reason of their governing characteristics and deserving of consideration as entities, that a description of it separately is of no commercial value. It is therefore defined merely geographically as follows: Brooklyn Bridge, Centre, Marion, Elm, Lafayette, Fourth avenue, Fourteenth, Irving place, Lexington avenue, Forty-fifth, Eighth avenue, Hudson, Spring, and the East and North Rivers. Within this section the values are fairly uniform along Broadway; north of Chambers street the heaviest values lie in the two blocks either side of Broadway proper, for the most part shading off from this toward the rivers. South of Chambers street is heavy value property, except a lower value strip along the docks, and fireproofs are thickest here.

Owing to the existing congestion and the high land values in the lower end of this section, and other causes, various industries, notably the theatres and retail drygoods concerns, are being driven farther north, to the end that in a few years the ultra-congested district will probably extend up to Central Park and include the blocks near the Park as well.

In the outlying sections of the island are several instances of small congested value areas, but their extent and importance are alike of relatively slight consequence.

## THE CITY DESCRIBED BY SECTIONS.

The size of the city, the magnitude of the problem of discussing its conflagration hazard and the absence of natural divisions or fire stops have dictated a special treatment of this subject. The city has been divided into arbitrary sections, each of which is defined and described. It is recognized that each section while possessing individual characteristics cannot be regarded as wholly independent. Therefore, after describing the main characteristics of each and giving a brief valuation of the conflagration hazard from the standpoint of possibility and probability, a conclusion is stated as to the significance of each section in its surroundings.

The various sections are shown in colors on Plan 1, which also shows the blocks in which the conflagration hazard is regarded as being above the average, as explained in the note on the plan. This plan and Plan 2, showing the water distribution system and pressures, should be examined in connection with the following descriptions.

**FIRST SECTION.—FINANCIAL.**—Comprising about 57 blocks and bounded by Battery Park, Pearl, Maiden Lane, Nassau, Chambers, Broadway, Vesey, Church and Greenwich streets.

This section, essentially a very high value, heavily congested one, is devoted principally to buildings of fireproof construction, occupied largely as offices by financial and general business interests. The values of land and buildings are higher than for any similar area in the island, and are steadily increasing, the new buildings being in general of greater height and value and superior construction to those they replace; practically nothing but fireproof construction is used for new buildings.

About 30 per cent. of the buildings are of fireproof construction, ranging from 3 to 30 stories in height, but mainly about 10 to 15 stories. The non-fireproof buildings are rather old, but for the most part in fairly good condition; they are 3 to 6 stories in height, of only moderate areas, with fair fire-walls, parapets and skylight conditions, and with vertical openings mainly unprotected. There are no frame or sprinklered risks.

The streets are uniformly narrow, averaging about 45 feet, though some are as narrow as 30 feet. They are all practically level, and there are no obstructions except for the elevated roads on Pearl, Church and Greenwich. The blocks in this section are uniformly of moderate area, compactly built, mainly without alleys, and largely without interior structures or courts. There are many instances of unprotected horizontal exposures in block interiors, but these are of comparatively small import here by virtue of the large percentage of fireproof risks in practically all blocks. Shutters or wire-glass are also lacking on nearly all street fronts and in numerous cases missing from fireproofs.

With the exception of a few small blocks and scraps of blocks between Broad, Pearl and Beaver streets, which are rather bad by reason

of a preponderance of old ordinary joisted bricks in none too good condition, there are no very bad blocks in the section. This section is too small to develop more than a purely local fire. There are no conflagration breeders of any description.

If openings in fireproofs were protected uniformly with wire-glass or other approved devices, the potential hazard in this section would be negligible; even at present it is very low; and the probability hazard is likewise inappreciable, by virtue of internal protection, care as to internal hazards, and automatic alarm systems, as well as the possibility of fire-boat protection.

Owing to the grouping of fireproofs, mutually sustaining, this section should also repel the attacks of any ordinary conflagrations east or west, though a serious conflagration northeast, aided by the explosive and inflammable occupancies there, might cause a heavy loss on the portion southeast of City Hall Park.

**SECOND SECTION. — CHEMICAL. —** Comprising about 56 blocks and bounded by the East River, Battery Park, Pearl, Maiden Lane, Nassau and Beekman streets.

This is a comparatively small section located mainly along the East River east and northeast of the financial section. The general occupancy, while nominally chemicals, oils and drug stocks, is by no means limited to these; in fact there is considerable similarity of occupancy between the north end of this section and the south end of the printing section just north; large numbers of printing and paper concerns are found in many blocks except those along the river, which hold cheap hotels and general shipping industries, teas, coffee, sugar, wine and flour. Less change is apparent in this than in any other sections in Manhattan, and comparatively few new buildings have been erected for many years, nor is much new work contemplated. Values are fairly high, owing to the congestion of risks and preponderance of warehouses and wholesale stocks, but the buildings themselves are rather old and poor.

The buildings are principally bricks, three to six stories in height, of moderate areas, ordinary or heavy joisted construction, and range in age from 10 to 50 years for the most part, being in just fair condition for age. Walls are of fair thickness, but only fairly well parapeted, and vertical openings are numerous. There are a few old frames of slight import; fireproofs are few, mainly less than 10 stories, and sprinkler protection affects the general situation to but a moderate degree.

The streets are practically level, but are somewhat winding and narrow, the average width being about 40 feet, and many being only about 30 feet wide. The only street obstruction of import is the elevated road on Pearl street. The blocks in this section are uniformly small, and mainly very compactly built with the old bricks described above; there are few interior structures, blocks being too small, and practically no alleys. Light courts are few, and horizontal exposures are unprotected except in comparatively few cases; notably, however, these occur where the oil hazards are most excessive. The proportion of large-area risks is small.

As shown on Plan 1 but twenty-four out of the fifty-six blocks can be classed as satisfactory, while the remainder, especially those within three blocks of the river-front, are bad in a fairly uniform way; that is, congested groups of old and rather poor bricks, carrying heavy and violently combustible stocks, and poorly separated by narrow, winding streets, most of the openings on which are unshuttered. The old brick and metal-clad frame market at Fulton and South streets, which occupies the block, is bad, though almost any of the explosives or oil risks should more properly be classed as conflagration breeders.

On these scores, the potential hazard is severe, and the entire section could easily be swept by one fire. The probability hazard is also high, being redeemed but slightly by the problematic fire-boat protection.

Owing to utter absence of fire-stops, a general conflagration in this section might spread uninterruptedly through the territory south of Brooklyn Bridge; it might be arrested by the heavy grouping of fireproofs in the financial section west, and should be, save under the most extreme conditions, but the loss from such a fire would be nearly total on this section, and very heavy on all adjacent ones.

**THIRD SECTION. — MACHINERY. —** Comprising 55 blocks and bounded by the North River, Battery Park, Church, Vesey, Broadway and Chambers.

A fairly heavy value section in which the heaviest values are located near Church street, with a very perceptible decrease toward the river. While nominally a machinery section, this industry is restricted to the eastern portion; the remainder being occupied as miscellaneous warehouses, a few factories and, along the western edge, fruit commission houses, markets, tenement mercantiles and cheap hotels. The trend of building is from formerly cheap tenements to heavily constructed storage warehouses; some fireproof buildings have been erected. Building operations throughout most of the section, however, have not been as active as in the sections adjoining.

Individual risks are generally 2 to 7 story ordinary and heavy joisted bricks of moderate

area with thin party walls, low parapets, poorly protected vertical openings and unscreened skylights; a few old and badly dilapidated frames still exist. Sprinklered, mill and fireproof constructed buildings form but a small proportion of the whole and are so scattered as to be of no more than local value as fire stops.

Streets throughout the section, including the boundary streets, vary from 20 feet to 80 feet, with an average width of about 55 feet; grades are uniformly level and the only obstructions are the elevated railroad structures along Greenwich and Church streets, which cover the streets from curb to curb and the station platforms of which extend almost to the building line and beyond at the cross streets. West street, 70 to 250 feet wide, is an effectual fire stop, cutting off the narrow strip of frame and metal-clad dock-houses and ferryboat landings along the river front.

Blocks are of small to medium area, but compactly built; inaccessible interior buildings are rare, but there are numerous interior courts with mutually exposing unprotected openings and a few frame rears; the percentage of large area risks is small, but, in a few instances, whole blocks have been built up as single risks, or by reason of intercommunications form single risks.

Out of a total of 55 blocks, 33 may be considered as bad, and of these many are very bad. There are several blocks northwest of the intersection of Vesey and Broadway which might become involved in a common fire owing to the prevailing light construction, mutual exposures, combustible occupancies, narrow streets, unprotected openings on streets and fronts vulnerable in other respects. The value of Church street as a possible barrier is materially decreased by the presence of the elevated road. Also the two blocks north of the intersection of Washington and Fulton streets contain mutually exposed and lightly constructed large area risks which are distinctive conflagration breeders. Immediately north and south of these two blocks and, in fact, extending practically the length of the section along either side of Washington street are bad or very bad blocks which would prove easy prey to fires of any magnitude in the adjoining blocks. The block between Rector and Morris and west of Washington is very bad, having in its centre a large great-height soap factory.

The potential hazard of the section as a whole is very severe, owing to the existing poor structural conditions and the large proportion of closely grouped bad and very bad blocks. The probability hazard is likewise very high, but is somewhat reduced by the infrequency of large-area conflagration breeders and by the fact that most of the section and also most of the bad blocks are accessible to fire-boat protection.

This section, together with the one adjoining to the north, and which would readily join in a common conflagration, seriously exposes the high value and financial section to the east, but the close grouping of fireproofs along Broadway should prove to be an effectual fire stop under most circumstances.

**FOURTH SECTION.—PRINTING AND LEATHER.**—Comprising about 30 blocks and bounded by the East River, Beekman, Nassau, Centre, Pearl, Park Row and Roosevelt streets.

This is a small section around Brooklyn Bridge, and while essentially a printing and leather district, it still holds scattering occupancies of tenements (these rather generally north of the Bridge), printers' ink and dry-color concerns, and some drug and oil stocks. The values are fairly heavy, consisting rather of grouped instances of heavy-value stocks than of uniformly high-value risks, and there is quite a proportion, especially along the east and north edges, of cheap buildings with light, mainly tenement occupancies. The values are generally on the increase, and all the building being done is of a superior type; however, the change is slow.

Most of the buildings in the east and north portions, and many elsewhere, are moderate area, 4 to 6 story ordinary joisted bricks, mainly old and in only fair condition; walls are of fair weight, but only fairly well parapeted at best; the skylight hazard is not severe; vertical openings are properly protected in the good buildings only. These obtain mainly in the west and southwest parts, and are mainly 5 to 12 story bricks of superior or fireproof construction. There are few sprinklered risks, and practically no frames.

The streets are very narrow, averaging about 35 feet, and many being but 15 to 25 feet in width. They are winding and are obstructed in the daytime by numerous trucks which render them hardly passable; the elevated road on Pearl is an added obstruction. Brooklyn Bridge forms a fair cut-off west of Vandewater only, dividing the section in halves, but the barrier is only partial, and there are warehouses under the bridge from the terminal east. Blocks in this section are of small to moderate size, mainly compactly built with the old bricks described, and with most of the openings on streets unprotected, as are also those on practically all but the good risks at the west end; the fireproofs are shuttered mainly only at the lower two exposed floors. In the

west end the preponderance of fairly good risks, fairly well shuttered, might aid in confining ordinary fires to the risks wherein they originate, but any fire once gaining general headway in a few risks could probably involve practically any block in this section, and, indeed, the section as a whole. The fireproofs are so sparse as to be of little avail.

Over half of the blocks in this section must be classed as rather bad, especially those east and north where conditions begin to approach more nearly those in the lower East Side tenement section directly above. There are practically no conflagration breeders in the strict sense of the term, but there are several instances of mutually exposed bad risks which could easily set up conflagration conditions; and practically any block could be the origin of a bad fire, owing to mutual exposures of old and serious risks.

The potential hazard in this section is severe; the probability element is fairly high, slightly mitigated at the western end by the bridge, and in general by the occasional shuttering of the larger risks.

This section is practically one with those north and south, but City Hall Park on the west cuts it off from the sections in that direction. Practically any general fire in the Chemical or East Side tenement sections could spread without interference throughout this section.

**FIFTH SECTION—WHOLESALE GROCERIES.**—Comprising about 83 blocks and bounded by the North River, Chambers, West Broadway and Spring streets.

This is essentially a heavy-value section, and one with marked latent conflagration possibilities. Formerly a largely cheap tenement district, it is now occupied mainly by wholesale grocery and kindred supply warehouses or factories; a considerable number of older tenements still remain, and while these, in some blocks, are of notable extent, they are gradually being replaced by modern fireproof buildings. Blocks are comparatively small, but generally solidly built up with mainly 3 to 10 story bricks of ordinary or heavy joisted construction; a small proportion of fireproofs and a lesser number of frames are scattered through, the former not being sufficiently grouped to be of more than local value as fire-stops.

With the exception of Canal and Hudson streets, which are respectively 100 feet and 80 feet wide, the street widths in this section average 60 feet, though in a few cases they are as low as 25 feet. There are 23 blocks or parts of blocks where conditions are bad, and of these 12 may be called very bad. The grouping of old or weak buildings with mutually exposing frame rears or unprotected openings across interior courts, the excessive heights for buildings of light construction, together with the heavy, and, in many cases, highly combustible stocks carried, combine to bring about these hazardous conditions.

Attention is drawn to the blocks near and surrounding the intersection of Reade and Washington streets. The buildings forming these, while of small to medium area, are of light construction and generally in poor repair, have poorly protected or unprotected horizontal and vertical openings, unscreened skylights and low parapets, and carry combustible stocks; on these accounts and owing to the occasional interspersion of dilapidated frames, fires would probably be rapid, and under adverse conditions these several blocks might become involved. Similar conditions exist in the two blocks north of the intersection of Harrison and Washington streets, where, in addition to structural defects, the hazardous hay and straw stocks and the combustible refuse accumulations in courts and on roofs create a serious hazard; again in the block bounded by West Broadway, Thomas, Worth and Hudson streets, where a large-area one story building in center of block with numerous skylights, exposes unprotected rears of surrounding risks. Similar conditions, to a less flagrant degree, prevail in the remaining blocks.

The potential hazard throughout the whole section is severe, on account of the existing serious conditions and the scattering of bad and very bad blocks. The probability hazard is also high, but is mitigated by the absence of any excessively large-area conflagration breeders, and by the fact that most of the serious blocks are located within three blocks of the river and are accessible to fire-boat protection.

Forming part of this section, but separated from it by a 250-foot street, is a row of frame and metal-clad dock-houses and ferryboat landings. While serious fires have occurred along the river fronts, these warehouses are not regarded as a serious exposure to the section as a whole on account of wide intervening street and good water-front protection.

Owing to the absence of any street worthy the designation of fire-stop, a well-developed conflagration in this section would probably involve portions of those immediately adjoining, and cause heavy loss of property in the high-value section east. The fireproofs along Broadway should, however, act as a barrier to any further spread.

**SIXTH SECTION.—WHOLESALE DRY-GOODS, ETC.**—Comprising about 110 blocks and bounded by Chambers, Centre, Marion, Elm, Lafayette, Eighth, University place, West Fourth and West Broadway.

So far as contents of buildings are concerned, the district is generally reputed to comprise the largest concentration of values in the country. The values of buildings are probably exceeded by those in the financial district, but there is a steady replacement in progress tending to the substitution of high value fireproof buildings for those of the older type. The dry goods district has three prominent characteristics:

1. The strictly mercantile occupancy.
2. The mercantile and manufacturing combined occupancy.
3. The tenant loft manufacturing occupancy.

The dry goods district contains in reality but very few sole tenant strictly commercial buildings. The great majority are multi-tenant buildings and the amount of manufacturing is great; in fact, all but a small proportion of the risks are manufacturing risks employing often large numbers of hands. The manufacturing is almost entirely of the lighter kind, dealing with articles of wear and ornament.

The hazards of the district have concentrated the attention of underwriters for years and there is perhaps a traditional attitude maintained with regard to it which may be inclined to disregard certain transformations that have occurred. It is certain that a large percentage of the dry goods district risks of importance are now either sprinklered or fireproof, or both. Yet it continues to include the greatest conflagration breeders in the city, the highest values, the greatest congestion, and the busiest manufacturing element.

Buildings are generally 4 to 7 story ordinary and heavy joisted bricks of moderate to large area, with mainly blank party walls, acceptable parapets, enclosed elevators and stairs and shuttered rear openings; usually in good repair and with small proportion of unprotected skylights. Fireproofs range from 7 to 15 stories in height and, in those blocks along Broadway, frequently cover a large portion of the area.

The average street width in this section is 50 feet with variations from 40 feet to 100 feet; Canal street 100 feet, and Broadway, 80 feet, are the only ones of any special note and divide the section into four unequal parts; while not of sufficient width to be considered as firestops, they help to segregate these four parts. Grades are uniformly level and streets without obstruction, excepting West Broadway, a boundary street, where there is an elevated railroad structure.

Blocks are mainly of moderate area, a few small ones being located in the northern part of the section, and they are practically all very compactly built. Interior buildings are few and, though there are many inaccessible interior courts, rear openings are generally fairly well shuttered; but there are frequently bad mutual exposures on account of unprotected openings on narrow streets. The large area risks, of which there are many, are generally sprinklered and have both vertical and horizontal opening hazards well guarded.

Considering the large number of blocks included in this section a very small proportion, only 11 blocks or parts of blocks, is listed as bad, and of these only two are very bad. The block bounded by West Broadway, Thomas, Church and Worth streets is occupied, with the exception of two small risks at the southeast corner, by a large wholesale drygoods risk divided into several two to five story heavy joisted brick sections; owing to the large undivided area of the largest section, numerous communications with other sections, high combustibility of stock and numerous unprotected vertical openings, this must be considered as a conflagration breeder in spite of its good sprinkler and other internal protection, although the probability element is greatly reduced by this protection; also across West Broadway, in Section 5, are two blocks shown as bad and very bad which would readily aid in creating a fire of conflagration proportions. The northern half of the block bounded by Broadway, Bleecker, Mercer and West Third streets contains two large area hotels of light joist construction which are mutually exposed. The conditions existing in those blocks marked as bad are generally unprotected openings mutually exposed across an interior court combined with one or more risks of large area and high combustibility.

The potential hazard of this section, except for the territory included between Broadway, Chambers, West Broadway and Canal is light by virtue of the better construction, higher class of occupancies and better internal protection than prevails in the surrounding sections and because of the few and well separated bad blocks. In the territory just mentioned the great height and size of the buildings and blocks, the frequency of iron fronts in rows and on opposite sides of narrow streets and the rather light interior construction, combined with combustible contents, make the potential hazard probably worse than it is in any area of similar extent in the city. The probability hazard is also light, but, on account of the prevailing lack of protection along street fronts and the rather narrow streets, several blocks might become involved in a common fire and set up conflagration conditions.

While this section is comparatively free from conflagration hazard within itself, except as noted, it is seriously exposed by and serves as a connecting link for the sections adjoining

both east and west, the arbitrarily selected boundary streets not being of sufficient width to constitute effective fire-stops. In the event of a general conflagration in either of the adjoining sections, there would undoubtedly be heavy losses in this section.

**SEVENTH SECTION.—LOWER EAST SIDE TENEMENT AND MANUFACTURING.**—Comprising about 230 blocks and bounded by the East River, Delancey, Bowery, Astor place, Lafayette, Elm, Marion, Centre, Pearl, Park Row and Roosevelt streets.

This is an irregular section of about one square mile in extent, occupied almost exclusively as cheap tenements and small factories and having for tenants all the poorest and cheapest classes, as well as practically all the foreign quarters, as Chinese, Italian, Jewish, etc. This section is one of the most heavily congested of any on the island, but the values are lower by virtue of the cheap class of buildings and occupancy. Some improved construction obtains in the extreme west portion of the section. Conditions are, however, fairly uniform throughout most of the section, and bid fair to continue so, for while the old and weak buildings are removed from time to time their successors are as yet too few and scattered materially to enhance either the value or the safety of the section.

The buildings in this district are largely 4 to 7 story ordinary or cheap joisted bricks of moderate area and in just fair condition, mainly, though there are many old and weak risks and frames which should be condemned, and which appear to be methodically collapsing. Walls are of just fair thickness, and parapets are low throughout; there is the usual quota of unprotected vertical openings in practically all risks. Fireproofs, semi-fireproofs, mill buildings and sprinklered risks are comparatively few.

The streets are very narrow throughout, averaging about 45 feet, many being as low as 30 feet in width; only a few widths exceed 60 feet, the Bowery being the only case of any consequence, and that is made of less value by the presence of an elevated road along either curb. Division and Allen streets are also to all intent obliterated as fire-breaks by elevated roads covering their entire widths. The blocks in this section are of moderate area, compactly built with the poorer class of buildings noted above; the practice. universal in this city, of omitting alleys, forms a somewhat unfavorable feature here, where the situation is further complicated by the fact that nearly all blocks have their entire interiors built solidly with cheap risks, frequently tenements with numerous unprotected openings, the effect being that practically any block in the whole area is subject to one fire. Owing also to the almost total absence of shutters both on streets and on rears of risks, a fire in any block might involve blocks in practically any direction. There is no adequate fire-stop, either in the way of open space or of mutually sustaining groups of fireproofs or other protected risks.

Generally speaking, these conditions, with the consequent inaccessibility of block interiors, render nearly all the blocks in this section bad; and they are particularly hazardous in the blocks shown black on Plan 1; conditions through the remainder of the section, however, are only slightly less serious. Indeed the only instance of mutually sustaining good blocks lies along the south river-front as shown, where the risks are largely well shuttered and well cared for warehouses. The docks do not seriously jeopardize the section at any point; factories are mainly small and not of special intrinsic hazard.

Owing to the general congestion, narrow streets and poor class, as well as to the inaccessibility of block interiors, the potential hazard must here be classed as severe. The probability feature, on the scores of moral hazard and the lack of sufficient fire-alarms, is also high, being modified only by the absence of specific conflagration breeders and by the possibility of fire-boat protection for some distance back from the river-front, where, however, few of the bad blocks are located.

Delancey Street Bridge, the northern boundary of this section, forms a fair cut-off save in the most extreme cases, and any but a general conflagration should be arrested at this point; the sections to the west and southwest, however, are fully exposed to any conflagration becoming general here. Indeed, this lower east side forms a dangerous exposure to the lower high-value district.

**EIGHTH SECTION.—LOWER WEST SIDE TENEMENT AND MANUFACTURING.**—Comprising about 220 blocks and bounded by the North River, Spring, West Broadway, West Fourth, University Place, West Thirteenth, Sixth avenue, West Fifteenth, Seventh avenue, and West Twenty-third streets.

This is a section with fairly heavy values, lying west of the wholesale and retail high-value sections, to which it forms one of the principal exposures. Its general occupancy is cheap tenement mercantiles with scattering factories, mainly at the upper end near the river, and with some better class mercantiles and dwellings near Washington square. Values through the rest of the district are fairly uniform, and show little variation from year to year; indeed, less change for better

conditions is noted here than in any other part of Manhattan.

The general character of risks shows slight variation; they are largely 3 to 6 story ordinary-joisted bricks of moderate area, and mainly rather old and in fair or only fair condition. Walls are rather deficient in weight and parapets are mainly low; vertical openings unprotected throughout. There are also many cases of thin-glass skylights, as well as frame cornices, sheds and awnings. The factory risks near Washington square are fairly good, but those near the river are generally old and in rather unsafe condition. Fireproofs are few and far between, as are also sprinklered risks.

Below Fourteenth street, streets are narrow, averaging about 45 feet, with many but 25 feet to 30 feet in width; above Fourteenth the avenues are 100 feet wide, and the streets running east and west are 60 feet; all are fairly level and in good condition; their principal obstructions are the Sixth and Ninth avenue elevated roads, the latter running also on Greenwich street. The blocks in this section are of small to medium area below Fourteenth street, above which they are large. All are fairly compactly built with the rather poor bricks just described; block interiors are uniformly inaccessible, all openings, both on streets and on interiors, are unprotected, and there is a considerable proportion of old and dilapidated brick and frame risks. Nearly any block below Fourteenth street is subject to one fire, save the higher class section near Washington square, where the inherent hazard is slight. There is no grouping of fireproofs, or other fire-breaks of any sort.

More than half the blocks below Fourteenth street may be classed as bad, as shown on Plan 1, owing largely to the narrow streets and mutual exposures of poor risks; above Fourteenth most of the long blocks show bad interiors, the most serious being those bounded by Tenth and Eleventh avenues from Eighteenth to Twenty-second streets. There are also some very bad blocks; among them, that bounded by Houston, Downing and Bedford, made serious by a poorly cared for oxygen factory; that bounded by Ninth and Tenth avenues and Fourteenth to Fifteenth streets, which has several lumber yards; and that bounded by Hudson, Eleventh, Bank and Bleecker streets, having unsafe woodworkers.

Owing to this preponderance of unsatisfactory conditions, the potential hazard is here very severe; and on account of the lower moral plane and the age and lack of internal protection of practically all risks, the probability hazard is also high, and is mitigated to a slight degree only by the possible fire-boat protection and the absence of any great number of conflagration breeders.

This section is practically one with those east, north and south, as no fire-stops are found, and conflagrations might spread in any direction, although fireproofs along Broadway might form a barrier there; and the north spread should be slower by virtue of the greater street widths in that direction.

**NINTH SECTION.—RETAIL MERCANTILE.**—Comprising 67 blocks and bounded by Eighth street, Fourth avenue, Fourteenth, Irving place, Twenty-third, Sixth avenue, Thirty-fifth, Seventh avenue, Fifteenth, Sixth avenue, Thirteenth, and University place.

This is a fairly uniform heavy value section with the extremes of higher value fireproofs along Broadway and Sixth avenue, and cheap tenements and mercantiles along Seventh avenue south of Twenty-third street. Besides the various retail industries, a list of the occupancies should include some wholesale warehouses and clothing factories in the extreme southern portion, a scattering of hotels and theatres along Broadway and numerous cheap tenement mercantiles along the western border. While the general trend is to better conditions and erect improved buildings, especially the building of fireproofs along Broadway and Fourth avenue, the larger department stores are gradually moving farther uptown.

Individual buildings in this section vary from the old 3 to 5 story small area, light joisted brick tenements with unprotected vertical openings, low parapets, frame cornices, etc., to the 4 to 8 story medium to large area, heavy joisted or semi-fireproof stores or warehouses with fair to good floor cut-offs, screened skylights and, frequently, good internal protection and the 7 to 20 story fireproof office buildings with open or enclosed vertical shafts. Fireproofs and sprinklered heavily constructed risks form a considerable proportion of this section. Streets throughout are of fairly good width for ordinary fire-stops, being 80 feet to 100 feet for the north and south streets and 60 feet for the cross streets, with occasional 100 feet variations, but cannot be considered as conflagration fire-stops. All are well paved, level and free from obstruction excepting Sixth avenue, where there is an elevated road; the fairly good width of this street, 100 feet, reduces the seriousness of this obstruction materially. Union and Madison squares, the former included within this section and the latter on the boundary, are of great value as local fire-stops, but would have little effect in the event of a general conflagration which could easily sweep around and possibly across them.

The blocks are mainly the long narrow undivided ones so common to Manhattan, although in the southern part of the section

there are many of small or medium area; all are fairly compactly built with numerous inaccessible courts in the interiors. Rear openings are mainly protected in the higher value blocks, but there is a notable lack of this in the older and cheaper blocks between Sixth and Seventh avenues; there are but few frame buildings or additions. In the higher value centers there are many instances of mutually sustaining groups of fireproof and sprinklered risks which would be of considerable value in resisting small local conflagrations.

A particularly bad block is bounded by Sixth and Seventh avenues and Eighteenth and Nineteenth streets, where a large unsprinklered joisted department store, interior bricks and frames and dangerous manufacturing concerns combine to form conditions which seriously menace the surrounding blocks. Other bad and very bad blocks are scattered, as shown on the map, and are serious because of the unprotected and mutually exposed interior openings with one or more large area or hazardous risks. There are but few instances of the grouping of two or more hazardous blocks and these are surrounded by blocks of integrity.

Aside from the few localities just mentioned, the potential hazard of this section is moderate owing to fairly wide streets and large proportion of fireproof and sprinklered risks. The probability hazard of the section is also fairly light as a whole, but severe in a few restricted portions.

The poorest parts of this section are those immediately adjoining and exposed by the poorer tenement and manufacturing sections to the west and southeast, intervening streets not forming any appreciable fire-stops. A sweeping fire in either of these exposing sections would probably cause heavy losses here, but, unless of very general proportions, should be checked by the groups of mutually sustaining fireproofs and sprinklered risks. The fireproofs along Broadway are as yet too few and their construction too open to act as an extensive fire-stop, but, with a continuation of their increase and a rigid enforcement of laws regarding the protection of exterior openings, it seems likely that within a few years there may be a fire-stop here of great value.

**TENTH SECTION.—THEATRE AND HOTEL.**—Comprising 52 blocks and bounded by Madison square, Fifth avenue, Forty-fifth, Eighth avenue, Forty-first, Seventh avenue, Thirty-fifth, Sixth avenue and Twenty-third street.

This section, an irregular strip along Broadway of about 20 blocks in length, is rapidly becoming an uptown high value district; nearly all available property fronting on Broadway and the principal cross streets is gradually being built up with fireproof hotels and theatres. Thirty-fourth street will, in the near future, be a department store center with one now at the corner of Sixth avenue and two similar buildings under construction either side of Fifth avenue. Other occupancies include the small area, high class mercantiles along Fifth avenue, the lower value tenement mercantiles along Sixth, Seventh and Eighth avenues, and the fair to good class of older dwellings fronting on the cross streets.

These older buildings are mainly 3 to 6 story small area joisted brick apartments of the usual construction; fireproofs vary from 7 to 24 stories in height, with an average of about 9 stories, and form about 15 per cent. of the buildings here.

The blocks along Broadway vary from small to fairly large area and all others are the regulation long, narrow undivided ones. The smaller blocks along Broadway are frequently built up solid with little or no interior courts and, in these blocks, exposed openings are mainly protected. The larger blocks have buildings on the four sides with unprotected openings toward an interior court, 40 feet to 60 feet in width and sub-divided into yards, running almost the length of the block; rear exposures are greatly mitigated by the width of this interior open space. There are comparatively few large area risks and these are mainly of fire-resistive construction, with good internal protection. Streets throughout the section are level, well paved and free from any obstruction except the elevated road along Sixth avenue; good street width here, however, reduces the seriousness of this obstruction. Nearly all streets are 60 feet wide, while the north and south streets and the two main cross streets are 100 feet; these widths should prove sufficient to prevent the block to block spread of ordinary fires, but cannot be considered as effective conflagration stops.

The dangerous blocks in this section are few, and these are dangerous rather by comparison with others in the section. Among them are the two small blocks west of the intersection of Broadway and Thirtieth street, where there are theatre stages located in the centres of the blocks with numerous unprotected and inaccessible openings on all surrounding buildings; also to the two small blocks of low buildings west of the crossing of Broadway and Thirty-eighth street, where there are hazardous groupings of automobile garages, livery stables, lumber yard and small shops; and also to the block northeast of Sixth avenue and Forty-second street, where there are large area risks of hazardous occupancy. In the two bad blocks on Broadway opposite Madison square, the hazardous conditions are

found in two large area hotels of joisted construction having numerous vertical openings. These blocks are grouped in couples, each small group being surrounded by blocks of integrity, and should not develop more than local conflagration conditions.

The potential hazard of the section as a whole is light on account of the fairly wide streets, large proportion of fireproofs and mainly low inherent hazards. The probability hazard is also light.

This section is somewhat exposed by the west side tenement district, but conditions there are not of a highly serious nature and fires should be confined to the blocks of their origin; adjoining on the east is a high class dwelling section from which there is little or no exposure.

**ELEVENTH SECTION.—WEST SIDE TENEMENT.**—Comprising 217 blocks and bounded by the North River, Twenty-third, Seventh avenue, Forty-first, Eighth avenue, Forty-fifth, Seventh avenue, Fifty-ninth, Broadway, and Sixty-ninth streets.

This is a large section of fairly uniform medium values with occasional groupings of heavy values in the factories near the Hudson River and a gradual increase toward the eastern boundary, where there are scattered high class fireproofs. While mainly a tenement section with a large negro settlement and with numerous small miscellaneous mercantiles along the north and south streets, it also contains many prominent manufacturing plants in the blocks west of Tenth avenue and a few fireproof hotels along Seventh avenue. Outside of these isolated high value risks and the modernizing of some of the factories, there is but little evidence of increase in values with the following notable exception: The four blocks bounded by Seventh and Ninth avenues and Thirty-first and Thirty-third streets are being excavated for a fireproof railroad station which will have its train sheds and tracks underground; an ultimate effect of this will probably be to increase values in the immediate vicinity, especially toward Broadway.

Individual risks, for the tenements, are 3 to 6 story, small area, light joisted bricks with open stairs and thin, low parapeted party walls; for the factories, 4 to 7 story, moderate area, ordinary to heavy joisted bricks with occasional mill buildings with fair floor cut-offs and good party walls; fireproofs run from 9 to 16 stories and are nearly all of modern construction, though lacking in window protection. In the older sections there are a few frame interior buildings or rows, but these form but a small proportion of the whole.

Streets throughout the section are of fairly good width for ordinary fire-stops, being 100 feet for the north and south streets, and 60 feet for the cross streets, with occasional 100 feet variations, but cannot be considered as conflagration stops. All are well paved, practically level and free from obstructions except Eleventh avenue, which is often blocked by freight trains, and Ninth avenue, where there is an elevated railroad; the fairly good width of this street materially reduces the seriousness of this obstruction. The fireproof railroad station being constructed in the southern part of this section and the DeWitt Clinton Park in the northern part, should be of considerable local value as fire-stops.

Blocks are long, narrow and undivided, being all about 200 feet wide and mostly 800 feet long. The majority are built in the form of a hollow rectangle with a 40 foot to 60 foot open space running down the centre. In the rows of tenements, long frame cornices are common and parapets low and weak; interior openings are rarely shuttered and light courts frequently reduce a row of buildings to one long risk. In the manufacturing blocks, buildings are of larger area, interior spaces built up and exterior openings mainly protected. Block to block exposures are, on the whole, slight on account of the medium to low heights of buildings and the prevailing fair to good street widths.

The most serious grouping of hazardous condition is found in the several blocks north of Forty-second street and west of Ninth avenue; here are found several lightly constructed large area manufacturing risks with highly combustible stocks mutually exposing one another, with frame rows and lumber yards immediately adjacent; a fire starting here and getting beyond department control could easily and quickly reach conflagration proportions and would probably involve a large number of the surrounding blocks, where conditions are none too good. Other instances of bad and very bad blocks are grouped in twos to fours and isolated by surrounding blocks of integrity.

The potential hazard of the section as a whole is moderate on account of the low height and small area of most buildings and the good street widths, although there is a number of blocks where this must be rated as severe. The probability hazard is also low for the section as a whole, but high in the instance referred to above.

This section is slightly exposed by the tenement and manufacturing section to the south, but good street widths should prevent the spread of all but unusually extensive fires. The higher value sections to the east and north of this are slightly, though not seriously, exposed.

**TWELFTH SECTION.—HIGH CLASS RESIDENCE.**—Comprising 288 blocks east and south of Central Park, bounded by: Central Park, Seventh avenue, Forty-fifth, Fifth avenue, Twenty-third, Lexington avenue and One Hundred and Tenth street; also 258 blocks west and northwest of Central Park, bounded by: Hudson river, Sixty-ninth, Broadway, Central Park West, One Hundred and Tenth, Morningside avenue, Amsterdam avenue, One Hundred and Twenty-fourth, Broadway and One Hundred and Twenty-seventh street.

**Sub-section A:** East and south of Central Park.

This is a long, narrow section extending from Twenty-third street north to the upper line of Central Park, between the hotel and east side tenement sections. Its occupancy is almost exclusively dwellings, with a fair sprinkling of hotels, apartment houses and clubs; some mercantiles on a few streets along Fifth avenue. The south part of this section is rather lower in value than the north, as it is of the older regime, and the highest class residence belt has been gradually moving farther north, until now the highest values lie within a few blocks of Central Park. The lower end, especially below Forty-second street, will be used less and less from now on for the higher class dwellings, and more for studios and the better grade of mercantiles.

The dwellings in this section, below the Park, are principally the ordinary-joisted 3 to 5 story bricks in fairly good condition, their walls being of good weight, areas small or moderate, and vertical openings of the customary small importance in risks of this class. Above Forty-second street the dwellings are more recent, of a higher class of construction and tenancy, and in many cases are even of fireproof or semi-fireproof description. The hotels and apartment houses scattered through are mainly of superior construction, from 6 to 21 stories in height, and mainly fairly new and in good condition. The proportion of this class of building is steadily increasing throughout the section.

The north and south streets are all 100 feet in width, except Park avenue, which is 140 feet; the east and west streets are practically all 60 feet in width; all streets are level, well asphalted and are not obstructed in any way. The blocks in this section are principally of good or large area, some being 1,000 feet in length and are generally compactly built around a hollow space in the centre, which space is usually about 60 feet or more between the rears of risks along east and west streets. The majority of the dwelling blocks are of this description and present no serious features of any kind. A few of the blocks where hotels or larger apartment houses are found are less satisfactory, and in some the absence of protection on horizontal exposures makes it possible to involve several risks in any serious single fire; however, no entire blocks are bad by reason of these conditions. An additional good feature is the fact that the higher risks have fairly good internal and standpipe protection. There are enough fireproofs in the blocks near the Park, so that the spread of a conflagration is there rendered practically impossible. The east end of this strip is naturally of somewhat lower class, and the values shade off eastward toward the east side tenement section adjoining.

There are but few bad blocks in this entire section, most of them being in the strip from Sixth to Seventh avenues from Forty-second to Fifty-ninth streets; and there is but one very bad block here, that from Fiftieth to Fifty-first street, which is made very serious by large-area ordinary-joisted street-car barns and other risks in rather poor condition. This block might involve others adjacent, but the spread would be slight, save under the most adverse conditions. The bad blocks are hazardous chiefly by reason of mutual exposure of cheaper, older risks and some warehouses and tenements. There are occasional rather large-area risks of rather flimsy construction, which expose several buildings; and shutters are entirely lacking in this western strip except in a few unimportant instances. The only cases of mutually exposing bad blocks are those from Sixth to Seventh avenue, from Fifty-second to Fifty-fourth street, and from Ninety-sixth to Ninety-eighth street, between Park and Lexington avenue, and even in these the hazard is hardly more than local, and does not jeopardize the section as a whole. The nearest approach to a conflagration breeder is the car-barn noted.

With the exception of the sections just considered, the potential hazard in this section is low and the probability hazard practically negligible. The potential hazard in this western part is higher, and partakes to some degree of the hazard in the tenement section exposing it on the west.

The lower end of this district below Forty-second street might be involved in a total conflagration of the east side, otherwise losses should be moderate. The portion from Forty-second to Fifty-ninth might be partially involved in the event of a conflagration in the tenement section west, but owing to the interspersion of low risks this is but a remote contingency.

**Sub-Section B:** West and northwest of Central Park.

This section is somewhat similar to the section just described, save that the blocks are far more open, there are many vacant lots, and

low risks, and all higher buildings are fairly well isolated. There are numerous high-class hotels and good apartment houses, many of which are fireproof. The class of occupancy is rather better toward the north of this section, in Morningside Heights, and also in the blocks contiguous to Central Park. The trend of building at present is toward the high-class mainly fireproof apartment house type, and the section seems destined gradually to fill up with buildings of this description.

There are a few rather bad blocks, but they are generally well isolated and are of little more than local hazard. Their seriousness consists mainly in rather large area stables and warehouses, some of which might be conflagration breeders were it not for their practical isolation; the worst blocks, and these only relatively, are those bounded by Sixty-sixth, Sixty-seventh, Columbus and Central Park West, and by Sixty-seventh, Sixty-eighth, Columbus and Broadway.

Streets are of same width as in the other sub-section, and except for the heights at the north are fairly level and all in good condition.

The potential hazard is here very low; the probability hazard is practically non-existent.

The section is only slightly exposed by the tenement district south, and on the north where the heights run down into Harlem at Manhattan avenue, but no conflagration originating here or elsewhere could gain serious dimensions anywhere in this section.

**THIRTEENTH SECTION.—EAST SIDE TENEMENT.**—Comprising about 600 blocks and bounded by Delancey, Bowery, Fourth avenue, Fourteenth, Irving place, Lexington avenue, One Hundred and Tenth street and East River.

A large, rather cheap class tenement section, with some manufacturing at the lower east end and thinly scattered along the river. The values and general prevailing conditions are similar to those in Section 7, the lower east side, in the part of this district below Twenty-third street, except that the streets are wider and blocks are somewhat more orderly. But the buildings are of the same description, to a great extent, and the occupancies, while slightly better in class, are principally low grade tenements with many small mercantiles in first floors, and with few and comparatively unimportant factories. The growth toward better conditions is more favorable; blocks are more exclusively of a dwelling nature, and the class improves gradually toward the north and also away from the East River. The west blocks adjoin the high-class residence section, and in many places partake considerably of their characteristics.

The dwellings are principally 3 to 5 story ordinary joisted bricks in fairly good condition, with moderate or small areas, and regulation wall thickness and skylight conditions; ordinary vertical stair openings are unprotected throughout. The apartment buildings at the southern part are of rather cheap construction, 4 to 7 stories in height, generally fairly new but in none too good condition. The factories are of two sorts, the good, small ones in good buildings at the southwest corner, and the large, generally old ones along the river, especially below Twenty-third street. These are in many cases of good area, with much frame used both in construction and in process. There are few fireproofs, mill buildings or sprinklered risks.

The north and south streets are largely either 80 feet or 100 feet in width, and the east and west ones mainly 60 feet, except at the extreme south, where below Houston street all are 50 feet in width, and for occasional wide thoroughfares, notably Fourteenth, Twenty-third, Thirty-fourth, Fifty-seventh, Seventy-second, and One Hundred and Sixth streets. All streets are fairly level, save for the steep slope toward the river from Third avenue, between Ninety-first and One Hundredth streets, and some heavy grades on Lexington avenue. The elevated roads on Second and Third avenues also form somewhat of an obstruction. The blocks in this section are of moderate area, generally compact, and almost exclusively with inaccessible interiors, due more to the absence of alleys than to interior structures. Above Twenty-third but few blocks are subject to single fires; for, while openings are unprotected throughout, the rear to rear exposures are not generally serious. Below Twenty-third, the same conditions prevail, as noted, as in Section Seven, save that the streets are wider and the general appearance more orderly.

Nearly all blocks south of Fourteenth street are bad, on account of inaccessible interiors, with many unprotected openings; there are some of these which would be termed very bad, but practically the whole south end is composed of these bad blocks mutually exposed. The very bad blocks consist principally of the woodworkers and coal and lumber yards near the river; notably east of Avenue "D" from Fifth to Eleventh streets, and from Avenues "A" to "C" from Fourteenth north to Twentieth. The gas plants, while large, are practically fireproof; and are also well cut off, as are the packing houses east of First avenue from Forty-third to Forty-sixth, the brewery east of Third avenue from Ninetieth to Ninety-third streets, and the lumber yards and risks east of First avenue from Sixty-second to Sixty-fourth, and from One Hundred and Fourth to One Hundred and Ninth streets. No blocks above Twenty-third street could be

termed dangerous in view of their limited capacity for involving large areas in the event of their destruction. The theatre block at Lexington and Fifty-eighth is rather bad, but the hazard is hardly more than local in character; this is true also of the dwelling blocks made serious by interior exposures and light courts, and located as shown on Plan 1, the only congested instances of such mutually exposing blocks being the following: Blocks east of Third avenue from Ninetieth to Ninety-eighth streets, of Second avenue from Eighty-eighth to Ninety-first streets, and of First avenue from Seventy-second to Seventy-sixth streets, and from Eighty-second to Eighty-fourth. There are no extensive serious sections, and the only large factories which might be classed as conflagration breeders are adequately cut off from the section as a whole.

The potential hazard above Twenty-third street may be considered moderate, owing to width of streets and generally small area and good condition of dwellings; below Twenty-third street it is rather high, owing to congestion and to exposures along river-front. The probability hazard above Twenty-third is slight; below Twenty-third it is considerable, owing to larger areas of unsatisfactory blocks, more conflagration breeders and generally lower moral status. Fire companies and fire-alarm boxes also are insufficient in number.

Delancey street might prove an adequate fire-stop on the south of this section save in the most extreme conditions, but any general conflagration in the lower end could sweep with ease into the high-value retail and residence section west across Lexington avenue; above Fifty-seventh street, the chances are slight for any conflagration to gain sufficient dimensions to involve much of this section, and the loss to adjoining sections should be nominal.

**FOURTEENTH SECTION.—HARLEM.**—Comprising about 700 blocks and bounded by the Hudson river, One Hundred and Twenty-seventh, Broadway, One Hundred and Twenty-fourth, Amsterdam avenue, Morningside avenue, One Hundred and Tenth, and the Harlem river.

This section comprises the entire portion of Manhattan north of One Hundred and Tenth street (Central Park north), except for the tract known as Morningside Heights. It is occupied almost exclusively as dwellings and apartment houses, with the usual complement of mercantiles along the principal centers of traffic. On the heights to the west the values are somewhat higher than through the rest of the section, where they are fairly uniform up to One Hundred and Fifty-fifth street, above which point there will be no congestion for many years. Much building is being done in the less settled portions of the section, especially in the eastern part and the more central portion west of the Harlem river. The class of buildings is gradually improving, though much of the new building is of the hazardous apartment house type discussed below.

The older dwellings, which form about half or more of the risks, are 3 to 4 story, small-area, ordinary joisted bricks, mainly in good condition; they have the usual vertical openings, and there are few frame porches; skylights are small and of slight importance; the worst feature, aside from some instances of common light-courts, is the presence of continuous frame cornices for a row of dwellings. The apartment houses are 5 to 6 stories in height, of rather flimsy construction in many cases, and grouped into blocks as noted below. There are practically no frame risks, few fireproofs, and the few factories are fairly well isolated.

The north and south streets are mainly 100 feet in width, save for Park avenue, the line of the New York Central Railroad, which is 140 to 150 feet in width. The east and west streets are 60 feet wide, with 100-foot to 125-foot avenues at advantageous intervals, notably at One Hundred and Sixteenth, One Hundred and Twenty-fifth and One Hundred and Thirty-fifth streets. The only adequate fire-stops are the parks along the foot of the heights, effectually cutting them off from the rest of the territory. The blocks in the main part are 500 to 900 feet in length, and are mainly solidly built up, either with dwellings, which blocks are principally of integrity, or with apartment houses, built in long uninterrupted rows; these are usually exposed by similar rows rear and often by similar blocks across the street, and are constructed with numerous openings on all sides, notably on light courts, which are found between each two risks, practically turning the entire block into a single risk. Several localities are made serious by such blocks. The mercantile blocks along One Hundred and Twenty-fifth street, Eighth avenue, and some others, are of ordinary description, and present no unusual hazard in any case.

There are, in a strict sense, no conflagration breeders. Several large plants are well cut off, and there is no instance of congested bad risks, the most serious features being the several cases of apartment house blocks mutually exposed; these are found between Seventh and Eighth avenue from One Hundred and Fortieth to One Hundred and Forty-fourth street, the four blocks northwest of the intersection of One Hundred and Twenty-third street and Morningside avenue east, and also at One Hundred and Fiftieth to One Hundred and

Fifty-third streets, between Broadway and Amsterdam avenue, with a few small groups of blocks or parts of blocks elsewhere. Fires in such groups might involve property in the two or three adjacent blocks, but should not involve the section as a whole. A combination of these conditions with dwellings having bad interior light shafts forms objectionable localities also between One Hundred and Eleventh and One Hundred and Eighteenth streets from Fifth to Manhattan avenues, save for the few interspersed acceptable blocks. A heavy fire involving ten or twelve blocks might be possible under adverse conditions only; this is the most serious hazard found in the section and it is mild.

Save for the cases of apartment house blocks, the potential hazard in this section is slight, and the section as a whole could probably never be involved in a general conflagration. Owing to the absence of specific conflagration breeders and to general good conditions and fairly responsible occupancy throughout, the probability feature is also low.

The section is cut off from all others either by parks or rivers, and neither exposes nor is exposed by any territory, with the exception of the upper east side tenement district, and even here the mutual exposure is slight, except under the most extreme circumstances.

**FIFTEENTH SECTION.—THE BRONX.**—Comprising the territory north and east of Harlem river to City line.

The Borough of The Bronx comprises a total area of about forty square miles of rolling country with varying elevations up to 200 feet above sea level. The congested portion lies in the extreme southern end immediately across the Harlem river from that portion of Manhattan known as Harlem and is about four square miles in extent. The remainder of the borough is principally open meadows, with scattered village-like settlements.

The Bronx is almost exclusively a residence and small mercantile section, although there is quite a number of rather large area manufacturing plants scattered about the congested part. Values, compared with those in Manhattan, are low and fairly uniform as far north as Tremont avenue (East One Hundred and Seventy-seventh street) with occasional blocks of undeveloped property and a gradual shading off to the north and toward the Bronx and Harlem rivers of scattered frames and open meadows. The open blocks south of Tremont avenue and along Third avenue north of this street, are rapidly being built up; the newer buildings throughout the section and those in process of construction are similar to the hazardous apartment house type discussed under "Harlem."

In the southern end of the congested district, the older buildings form about half or more of the blocks and are 3 to 5 story, small-area, ordinary joisted brick apartments, mainly in good condition; vertical openings are unprotected, party walls thin and with low parapets, and there are a few frame porches; frequently buildings are in rows with common frame cornices. The newer apartment houses are 5 to 6 stories in height, of light joisted construction and grouped into rows or hollow-square blocks, as in Harlem. In the northern portion of the district there is a considerable proportion of frame dwellings, sometimes detached and with peaked shingle roofs, but generally semi-detached or in rows of three or more narrow flat-roofed buildings. There are practically no fireproofs and the few factories are fairly well isolated.

Streets throughout the congested portion are from 50 feet to 100 feet wide, well paved and grades are generally light and easy, although in a few instances there are rather steep hills a block or more in length. There are no obstructions except elevated railroad structures along Third and Westchester avenues. Streets in the outlying sections are mainly unpaved country roads, which, in continued wet weather, would probably become practically impassable for heavy department apparatus; fire apparatus is often delayed by snow. The blocks throughout the most closely built sections are mainly the hollow square type described under Harlem, and are exposed by similar blocks; there are no shutters, excepting on a few of the larger factories, and fire-escapes in a majority of cases are on the rears of apartment houses and lead to inaccessible interior courts. In a few blocks in the northern part of the congested district, nearly all buildings are frame and would fall easy prey to sweeping fires. In the outlying village-like settlements nearly all buildings are of frame, but there are generally good yard spaces intervening and no conflagration probabilities.

The only blocks which may be considered as bad are the undivided sections along the Harlem river. Here, east of Third avenue, is an extensive railroad yard which has no internal protection and city hydrant service along the northern or street side only. West of Third avenue and extending to One Hundred and Forty-ninth street are lumber yards with woodworking plants interspersed and a large metal working plant and several frame coal docks at the south end. Conditions are favorable to quick spreading fires and, in view of the inaccessibility of a large part of the area to street hydrant protection and of the fact that this district is without fire-boat protection, there are latent conflagration possibilities which, under very adverse conditions of high

wind, low water pressure, etc., might involve nearly all the blocks south of East One Hundred and Thirty-eighth street. There is another rather extensive railroad yard at Leggett avenue and East River, which is practically without fire protection on account of its inaccessibility and remoteness from street hydrants. The Mott Haven railroad yard between One Hundred and Forty-ninth and One Hundred and Sixty-first streets and east of Cedar Park, is surrounded by street mains and hydrants besides having considerable private protection.

Aside from the rather serious conditions existing at the extreme southern end of the section, the potential hazard is slight and the so-called congested portion of The Bronx could probably never be involved in a general conflagration. Owing to the general good conditions prevailing throughout the section and the absence of conflagration breeders, the probability feature is also low.

The Bronx is well isolated by the Harlem river and neither exposes nor is exposed by any other section.

**CONCLUSIONS.**—The features contributing to and most seriously affecting the conflagration hazard in this city are the size and hollow-square formation of the blocks, making them in effect single risks in many cases; the large number of conflagration breeding blocks; the wide areas which, while not made up of bad individual blocks, contain weak units, form conflagration "feeders," and abut upon dangerous territory containing numerous conflagration "breeders"; the narrow streets and general absence of fire-breaks in connection with the average great height of buildings; the frequency of unprotected vertical and horizontal openings, particularly excess-height openings; the high winds; the practically uniform inability of the water distribution system to supply the demands of third alarm fires; the physical conditions interfering with the proper handling of the fire department apparatus; and the antiquated, deteriorated and unreliable fire alarm system.

From the standpoint of probability, there is slight chance of a general conflagration anywhere north of Twenty-third street; indeed, if the rear protection recommended be provided, it will make this territory practically immune.

Below Twenty-third street, however, the situation is far more serious. Here are three localities of special and unusual hazard to the city at large. These sections, which have been described in detail under the numbers given, are as follows: Section 7, the Lower East Side Tenement and Manufacturing Section; Section 8, the corresponding West Side section; and Section 2, the Drug and Chemical Section south of Brooklyn Bridge. This last, while slight in extent, could readily become the origin of a peculiarly dangerous conflagration on account of the explosive and inflammable nature of its occupancy. The highest-value sections near Broadway are fairly good throughout, except as noted in the wholesale dry goods district, being largely of a fire-resistive character, but they are exposed in all directions by the sections noted, owing to the total absence of adequate fire-stops.

The most serious menace to the city as a whole is the lower east side, especially that part south of Delancey street; the exposure from this section to the lower end of the island has been much underestimated, and that conflagrations of record dimensions have not already occurred must be attributed largely to the vigilance of the fire department and the fact that fires have been caught in their incipiency. This area, a square mile in extent, subject to practically any fire getting beyond department control, with its crowded tenements full of foreign, low-grade and ignorant communities, together with the present inadequacy of water supply and scarcity of fire-alarm boxes, forms to the high-value sections west a menace, the seriousness of which has not been appreciated. In this connection attention is called to the low water pressures and the distribution system in this territory, as shown on Plan 2.

The same conditions prevail, though with less severity, in the west side tenement section, especially at the lower end.

In general, the safety of Manhattan is jeopardized by these three sections and by some unsatisfactory conditions in various other parts. Owing to the uniformly high values and general congestion and the certain dire consequences bound to follow a general conflagration in this city, immediate steps should be taken to improve conditions. The importance of the city naturally leads to the expectation that novel methods of improvement will be advocated, but the needs of the situation are such that time should not be wasted upon untried schemes or in searching for unique remedies when a simple, homely cure is at hand. The city should attack the problem by aiming first to insulate the individual building, compelling window protection on all exposed rear and side openings and on front openings where the streets are narrow. It should then push to completion and extend the separate fire main system which should be used on first alarms, engines to be kept in reserve as a second line of defense. The general recommendations elsewhere in this report cover other conditions.

# RECOMMENDATIONS.

## WATER SUPPLY.

1. That the installation of a separate fire main system, the same in all essentials as that now authorized for a portion of the city, be extended as rapidly as possible by continuous construction throughout the area now dependent for fire supply upon the Manhattan Low service, and to those areas east and south of Central Park supplied by the High service, with extensions to other sections when and where required to give a satisfactory protection to them. A pressure of not less than 150 pounds to be kept on the mains at all times, for the satisfactory operation of individual building protective devices and to avoid the evils of sudden, great changes in pressure on the system.

2. That future extensions and improvements in The Bronx and that portion of Manhattan now supplied by other than the Low service be designed for the eventual supply to the present Upper High service in Manhattan, and the High service in The Bronx, by pumpage at minimum pressure of upward of 70 pounds, and to other portions by direct gravity pressure from the proposed Hill View reservoir when available; distributing mains to be in accordance with the following general specifications:

*a.* All mains supplying hydrants in mercantile, manufacturing, warehouse, lumber and congested residence sections to be in general not less than 12 inches in diameter.

*b.* Eight inches to be adopted as the standard minimum size of mains used for hydrant supply and no new installations made of lesser sizes, even in outlying residence districts.

*c.* All mains supplying hydrants which are not more than 4 inches in diameter to be forthwith replaced by mains not less than 8 inches diameter.

*d.* In residence districts where the present distribution system consists of 6-inch mains, the system be strengthened where necessary by the immediate insertion of larger mains into the gridiron in such manner that all 6-inch mains will be fed by the larger sizes at intervals not exceeding 500 feet. This will be recognized as furnishing a fair protection for the present pending the ultimate substitution of 8-inch or larger mains for all of lesser size.

*e.* Dead ends of pipe mains along service limits to be eliminated by cross-connections or by double mains in streets at limit of services.

*f.* All dead ends of pipe mains to be connected with the gridiron system wherever practicable.

3. That the following additional arteries be installed in the Manhattan Low service to reinforce supply where abnormally deficient, pending the installation of the separate fire main system:

| Minimum Diameter. | Along. | From. | To. |
|---|---|---|---|
| 36" | 21st Street, Marginal Place, Avenue C, Pitt Street, Gouverneur Street, Cherry Street and Chambers Street. | Fifth Ave... | Madison St. |
| 20" | 125th Street and First Avenue..... | Second Ave. | 110th St. |

4. That, pending the ultimate supply of the Main High service from Hill View reservoir, the One Hundred and Seventy-ninth street pumping station be remodelled in such a manner as to ensure an uninterrupted supply at least equivalent to the maximum rate of consumption in the service. Besides the necessary installations of additional pumping and auxiliary machinery, particular attention should be given to details of piping, such arrangements being adopted as will avoid interruption of service during repairs. Note.—The Ninety-eighth street station, while ordinarily available for this service, is unreliable.

5. That the main now being laid by the department to furnish assistance from Jerome Park pumping station to the Upper High service, be completed at the earliest possible moment.

6. That the piping at the Jerome Park pumping station be redesigned to ensure uninterrupted service during ordinary repairs, as indicated above, for One Hundred and Seventy-ninth street station.

7. That the city be permanently districted for the purpose, and work energetically continued at once to determine the distribution of the waste, with particular attention to the cause of the unusually high rate of minimum night flow.

8. That, as the most effective way of reducing the large waste from defective plumbing and fixtures, a more general use of meters on services be encouraged by a proper readjustment of meter rates; the intelligent application of a policy of metering first the larger unmetered services with the eventual extension of meters to all services cannot fail to accomplish the desired result, as has been amply demonstrated by experience elsewhere.

9. That the survey recently instituted by the chief engineer for the preparation of an accurate plan of the distribution system be pushed with all possible vigor.

10. That repair companies be strengthened and members, especially foremen and sub-foremen, be required to familiarize themselves with details of the distribution system.

11. That the headquarters of repair company No. 2 be established at a more central location in the district.

12. That all fire alarms be sounded in headquarters of the several repair companies.

13. That a competent foreman familiar with the distribution system and at least one man respond to all second alarms of fire to open and close gates and otherwise co-operate with the fire department.

14. That facilities of the department be made adequate to handle all usual repair work.

15. That present conditions with respect to electrolysis of water mains be thoroughly investigated, with particular attention primarily to suspected points in The Bronx; systematic electrical surveys to be continued from year to year to locate any dangerous electrolytic conditions, and proper remedial measures promptly adopted to eliminate such as are found to exist.

16. That, where a single break would cut out of service 1,000 feet or more of mains directly supplying hydrants, additional gates be installed, so that not more than 500 feet of mains will be so affected.

17. That all valves on street mains which close by turning to the left be replaced at once by right-hand valves.

18. That all gate valve vaults and boxes be provided with standard department covers, to be kept clear at all times of building materials or other obstructions which interfere with the prompt closing of valves in emergency.

19. That all future installations of distributing mains be equipped with a sufficient number of gate valves, so located that no single case of accident, breakage or repair to the pipe system in mercantile, manufacturing and congested residence districts will necessitate the shutting from service a length of main greater than the side of a single block or a maximum of 500 feet, or in case of other districts lengths not greater than two sides of a single block with a maximum of 800 feet.

20. That the thorough inspection and repair of the larger gate valves be continued and extended to the smaller gates, and in future all gate valves be inspected at least once a year and kept in order.

21. That, in connection with measurements of flow for waste prevention, particular attention be given to locating any valves in street mains which may be closed unknown to the department.

22. That a confirming notice in writing be given fire department of all opening or closing of gate valves, and that a permanent record of same be kept by water department.

23. That all future installations of hydrants other than those of the separate fire main system be in accordance with the following specifications:

*a*. All hydrants in districts other than those of a strictly residence character to have at least two 4½-inch steamer outlets, each fitted with independent gate, not less than 8-inch barrel, and connection with main by pipe at least 8 inches diameter, the latter fitted with gate between street main and hydrant.

*b*. All hydrants in strictly residence districts to have at least one 4½-inch steamer outlet and one or more hose outlets, each provided with independent gate, not less than 6-inch barrel, and connection with main by pipe at least 6 inches diameter, the latter fitted with gate between street main and hydrant.

24. That, after a careful detailed study by the water department of the situation in the area to be eventually covered by the separate fire main system, all single 2½-inch outlet hydrants, at locations where distributing mains are such that larger and better hydrants would receive satisfactory supply, be replaced by others in accordance with the foregoing specifications; this, if done at once, will materially strengthen the fire protection pending the ultimate installation of the separate fire main system.

25. That, using the results of the hydrant study just recommended, those hydrants which are found upon careful investigation to be capable of furnishing 600 gallons per minute, or more, under ordinary conditions of fire department use, be designated by painting in some distinctive color; this will avoid needless delay at critical times in getting the best obtainable supply, and leave the less efficient hydrants as a line of second defense.

26. That in sections without the area to be eventually covered by the separate fire main system, all hydrants in service provided with but a single outlet be replaced forthwith in accordance with the foregoing specifications.

27. That the use and abuse of hydrants by unauthorized persons, now general, be stopped, and measures taken to prevent the damage to hydrants resulting from the present indiscriminate use by street cleaners and other city employees.

28. That hydrant inspections by the water department be made more rigid and extended to cover all of the hydrants.

Note.—The National Board believes that it is essentially the business of each municipality to lay out its own system of distributing water mains, as the municipality alone is able to judge of the present and future needs of water for domestic purposes in each district; but practical experience has shown it to be unsafe to rely on a water supply for fire-fighting purposes excepting when delivered from well-gridironed systems of mains not less than 12 inches in diameter in important mercantile and manufacturing districts, or 8 inches in diameter in residence districts.

## FIRE DEPARTMENT.

29. That the incumbent of the office of fire commissioner be of demonstrated administrative ability and free from active political affiliations.

30. That the fire districts be rearranged so that they may be more accessible to the deputy chiefs in charge.

31. That increased weight be given to the records of candidates for promotion, and that examinations for promotion to the higher positions in the uniform force be non-competitive.

32. That members be retired from active fire duty on reaching the age of 62 years, unless at that time they are unusually efficient.

33. That an able and expert mechanical engineer, with one or more assistants, be appointed supervisor of machinery and be given full control of the operation, repair and testing of all apparatus and of the fitness of the engineers of steamers and their assistants. He should be held personally responsible for the condition of every engine and other piece of apparatus in the department, and should test all new and repaired engines before they are placed in service. His duties should include the supervision of all engines in operation at second and subsequent alarm fires.

34. That all engineers of steamers now in the department be subjected to a thorough, practical examination as to their ability in running and caring for engines, and only those who are fully competent be permanently retained.

35. That the abler engineers of steamers be attached to companies in the more hazardous localities.

36. That the grade of assistant engineer be created, to be filled only after suitable instruction under well qualified instructors. Candidates should be required to obtain the full working capacity from engines in good working condition before being appointed assistant engineers, and no fireman should be eligible to promotion to the grade of engineer of steamer until he shall have served one year as assistant engineer.

37. That additional engine companies be established near the following locations:

Near W. 53d Street and 5th Avenue.
Near W. 56th Street and 11th Avenue.
Near W. 93d Street and Amsterdam Avenue.
Near E. 113th Street and 1st Avenue.
Near W. 123d Street and 8th Avenue.
Near W. 151st Street and 8th Avenue.
Near W. 181st Street and Audubon Avenue.

After engine company 38 is moved to the proposed house at One Hundred and Sixty-first street and Amsterdam avenue, an additional company will eventually be needed in the neighborhood of West One Hundred and Fifty-first street.

38. That engine companies 1 and 17 be made double companies.

39. That engine company 15 be moved to the vicinity of Delancey and Willett streets.

40. That hose companies be established near the following locations:

Near Jefferson and Monroe Streets.
Near Greenwich and W. 12th Streets.
Near E. 20th Street and Avenue A.
Near W. 23d Street and 11th Avenue.
Near E. 34th Street and Lexington Avenue.
Near E. 59th Street and 2d Avenue.
Near E. 82d Street and 1st Avenue.
Near E. 96th Street and 2d Avenue.

Pending the completion of the separate fire main system called for in Recommendation No. 1, each of these companies should be equipped with an engine of not less than 700 gallons actual working capacity.

41. That the engine companies located in the territory to be protected by the separate fire main system be changed on the completion of that system to hose companies, most of which should be subdivided into two sections, each equipped with a separate hose wagon. Those companies which regularly respond to first or second alarms outside the protected territory should retain their engines in service.

42. That the engine companies in the territory adjacent to that protected by the separate fire main system, be equipped with two engines. One of these to supply water to the hose companies responding on third and subsequent alarms.

43. That additional ladder companies be established near the following locations:

Near Cherry and Montgomery Streets.
With the proposed company near E. 20th Street and Avenue A.
With the proposed company near W. 23d Street and 11th Avenue.
Near E. 38th Street and 2d Avenue.
With the proposed company near E. 59th Street and 2d Avenue.
With the proposed company near E. 82d Street and 1st Avenue.
Near E. 99th Street and 2d Avenue.
Near W. 116th Street and Amsterdam Avenue.
Near E. 152d Street and Prospect Avenue.
Near W. 188th Street and Amsterdam Avenue.

The foregoing additional engine and ladder companies are exclusive of those which have been already authorized by the fire department.

44. That additional protection be provided for several outlying communities, such as:

Hunt's Point Village.
Boston Post Road and Pelham Avenue (Bronxdale).
Baychester.
Eastchester.
Van Nest.

45. That an additional fire boat company be established on the North River near Twenty-fourth street. When this company is put in service, engine 78 should be shifted to a berth further south, in the vicinity of Christopher street.

46. That two additional water towers and the reserve tower be put in service; one near Fulton and Church streets, one with engine 56 at West Eighty-second street near Columbus avenue, and one near East One Hundred and Forty-third street and Third avenue.

47. That the second sections of all double engine companies be equipped with engines of the same size as those assigned to the first sections.

48. That every engine be given an exhaustive test, pumping against a water pressure 100 pounds in excess of hydrant pressure, and only those which are able to maintain a discharge of at least 650 gallons per minute be retained for service in Manhattan. Those engines which fail to discharge 90 per cent. of their rated capacity should be overhauled, and those which fall below a discharge of 500 gallons per minute after overhauling, should be discarded.

49. That the pumps and boilers of the following engines be put in good condition: Engines 2, 11, 13, 16a, 18a, 26a, 30b, 33a, 33b, 34, 37, 45, 71, 80a; reserve engines: first battalion, seventh battalion.

50. That no engine smaller than second size be retained for regular service within the fire limits, except where unusual grades make a smaller engine desirable.

51. That the apparatus throughout the city be so provided with chemical tanks that at least two companies so equipped shall respond to each first alarm.

52. That a reserve hose wagon carrying 1,200 feet of 3-inch hose be stationed in each battalion, such wagons to respond to second alarms in their respective districts.

53. That two 3-gallon portable extinguishers be included in the equipment of every hose wagon.

54. That all hose to be used in connection with the separate fire main system be equipped with a suitable signaling device to provide communication between the pipemen and hydrantmen.

55. That all 3-inch hose be fitted with 2½-inch couplings, 4-inch hose with 3½-inch couplings, and the variety of coupling dimensions in use be reduced to a minimum.

56. That a deluge set, turret nozzle or other device for conveniently handling powerful siamesed streams be carried on every hose wagon.

57. That one extension ladder 60 or 65 feet long be added to the equipment of the principal ladder trucks, and that aerial trucks purchased in the future be of a quick-raising type.

58. That not less than five engines be assigned to respond to first alarms at all those localities where the conflagration hazard is particularly severe.

59. That two water towers be regularly assigned to third alarms from localities where their services may be required.

60. That use be made of siamesed streams whenever single streams are ineffective or when unusually powerful streams are required. Their employment should be part of the regular routine of engine companies at second and third alarm fires.

61. That instead of dismissing engines from fires when the supply of water proves inadequate, such engines be sent to more remote hydrants on large mains, and their services be utilized through siamesed lines of hose.

62. That the period of probation be extended to at least three months, with drills to be continued after the first month.

63. That selected members from every company be drilled at regular intervals.

64. That the chief be given exclusive authority to enforce discipline.

65. That such treatment be accorded the associations among the members of the department as will minimize their harmful effect upon discipline.

66. That days off, meal hours and other leaves of absence be so assigned that not less than seven men shall be present in quarters at all times in every engine company and eight men in every ladder company. Exceptions may be made in extreme outlying companies.

67. That not more than one fireman be detailed to any theatrical performance. It is recommended that one or more employees of each theater be instructed by officials of the fire department and be authorized to act as theater firemen during performances; such employees to be properly uniformed and to have no other duties while audiences are present.

68. That the equipment of the new repair shop be promptly completed and made ready for work.

69. That the annual reports be published without unreasonable delay.

## FIRE ALARM SYSTEM.

### MANHATTAN.

70. The engineers of the National Board having closely co-operated with Mr. Kempster B. Miller, the expert employed by the Committee on Fire Alarm Service, Mr. Cecil F. Shallcross, Chairman, of the New York Board of Fire Underwriters, in the construction of the report issued in September, 1905, upon the fire alarm service of the Borough of Manhattan, the recommendations made in that report are endorsed and adopted by the National Board.

### THE BRONX.

71. That The Bronx fire alarm headquarters be moved to a building of fireproof construction, free from inside and outside hazards.

72. That an adequate force of trouble men be assigned to headquarters.

73. That the fire alarm circuits within the fire limits be put underground, and the layout and construction of the circuits be made in accordance with Recommendation No. 70.

74. That not more than 15 boxes be connected to any box circuit.

75. That the circuits of primary notification be used exclusively for transmitting alarms of fire.

76. That one or more special circuits without boxes connect The Bronx headquarters with Manhattan headquarters, and be regularly utilized for the automatic transmission of all alarms between those offices.

77. That boxes conforming with Recommendation No. 70 be substituted for those now in service.

78. That all boxes within the fire limits be mounted on special fire alarm posts, equipped with red lights, and stationed in conspicuous locations on street corners, not some distance removed from such points.

79. That additional boxes be installed so that no building inside the fire limits shall be more than 600 feet from some box, the usual maximum distance being 500 feet; in the outlying territory no valuable group of buildings should be more than 700 feet from some box.

80. That engine houses 61, 64 and 70 be equipped with gongs.

81. That all box and alarm circuits be tested at least hourly, and every alarm box at least monthly.

## FIRE DEPARTMENT AUXILIARIES.

82. That the men and horses of the fire patrol be called to the main floor at night only on signal from the man on watch.

83. That the police patrol wagons be equipped with ropes for establishing fire lines, and the number of fire line passes be restricted.

84. That fire alarm gongs be installed in the emergency stations of the principal street railway, electric light and gas companies, and that employees be sent by these corporations to perform such duties at fires as may be assigned by the officer in command.

85. That all installations of auxiliary and automatic fire alarm systems under the supervision of the city be brought up to the standard of the National Board wherever defective.

86. That the owners of extensive establishments be encouraged to equip their premises with auxiliary boxes operating the street boxes of the city fire alarm system, with some approved automatic alarm system, or with both.

87. That the fire department assign an experienced officer to supervise the instruction and training of private fire brigades upon request.

88. That the officers of private fire brigades be instructed to call promptly for the assistance of the city fire department.

## BUILDING DEPARTMENT.

89. That the laws be revised so as to meet the conditions under which the city is developing and conform with modern views, particularly as to limitations for excess height and area, as to protection for vertical and horizontal openings and as to thickness of walls. It is suggested that the building code recently prepared by the National Board of Fire Underwriters be used as a guide in framing new laws.

90. That the supervision of building construction be a function of the city instead of the separate boroughs.

91. That the laws be fully and impartially enforced.

92. That the qualifications for inspectors be sufficiently exacting to insure the retention of competent men only.

93. That responsibility for the enforcement of the fire-escape ordinances be fixed upon one department.

94. That the fire-escape ordinances be rigidly and impartially enforced.

95. That the fire limits of Manhattan include the whole island and those of The Bronx be extended to provide for the development due to increased rapid transit facilities.

96. That the office accommodations in Manhattan be increased to give adequate storage facilities for plans and records.

## EXPLOSIVES AND INFLAMMABLES.

97. That an adequate force of inspectors be appointed.

98. That with such increased force of inspectors systematic re-inspections be made of all premises coming under the jurisdiction of the Bureau of Combustibles.

## ELECTRICITY.

99. That a complete re-inspection of old wiring be made and defects corrected.

100. That all wiring be subsequently reinspected at suitable intervals.

101. That electrical contractors be required to obtain a license.

102. That all wiring within the fire limits be placed underground as soon as practicable.

103. That all low tension circuits, such as those utilized for telephone, telegraph and signalling purposes, be carried in separate subways and manholes from those occupied by lighting and power circuits.

104. That tests for electrolysis be continued, especially in The Bronx.

## CONFLAGRATION HAZARD.

105. That prompt measures be taken to relieve hazardous conditions in narrow streets by widening the streets, by enforcing adequate window protection, or by combining both methods.

106. That automatic sprinkler equipments be required in all buildings which, by reason of their size, construction or occupancy, singly or combined, might act as conflagration breeders.

# GENERAL SUMMARY.

## CITY IN GENERAL.

**Area.**—Greater New York, 326.9 square miles; Manhattan and The Bronx, 62.58 square miles.

**Population.**—Greater New York in 1905, 4,014,304; Manhattan and The Bronx in 1905, 2,384,326.

**Principal Industries.**—Clothing, tobacco, cigars and cigarettes, printing and publishing, foundry and machine shop products, furniture and cabinet making, book binding, electrical apparatus and supplies, musical instruments, silk and silk goods, etc.

**Topography.**—Manhattan Island is hilly in the northern part, with mercantile sections comparatively flat at lower elevation. The western portion of The Bronx is hilly, with the mercantile section in the southern part comparatively level.

**Streets.**—In the downtown district east-west streets are mostly under 70 feet wide, with many from 20 to 60 feet; above Houston street generally 60 feet in width, with streets 100 feet wide about every ten blocks; north-south avenues are nearly all 75 feet or more in width and are mostly 100 feet or more wide. In The Bronx, north-south streets are in general from 60 to 100, and east-west streets from 60 to 80 feet wide; some 100 feet or more in width; in the mercantile section north-south streets are 80 to 100 feet and east-west streets 60 feet wide. Surface of streets in Manhattan and of paved streets in The Bronx generally satisfactory; a large proportion of outlying streets in The Bronx are unpaved.

**Fuel.**—For manufacturing, coal, largely anthracite; for domestic use, gas and anthracite.

**Winds.**—Winds of high velocity frequent; prevailing direction northwest.

**Temperatures.**—Extended periods of severe cold weather are common.

**Fire Record.**—Losses moderate, with few widely extensive fires.

## FIRE FIGHTING FACILITIES.

**Water Supply.**—Works owned and operated by municipality. Management as reflected in maintenance of distribution system decidedly inefficient, but recent innovations in organization and method show improvement. Supply so deficient as to give rise to grave danger of water famine in a dry year. Distribution in six services; the lower lying portions of Manhattan, including most of the mercantile and manufacturing sections, and nearly all of The Bronx supplied entirely by gravity, with local storage in distributing reservoirs; higher services, mainly residence sections, by pumpage within the city limits from aqueducts, with small storage in equalizing reservoirs and tanks. Distributing reservoirs in the city hold about four days' supply; will be augmented shortly by basin approaching completion to about one week's supply. Rate of consumption not abnormal in comparison with other large cities, but present knowledge shows waste to be decidedly large. Pressures generally inadequate; in mercantile and manufacturing sections of Manhattan from 7 to 42 pounds, average 26 pounds; in the congested mercantile and manufacturing sections of The Bronx from 9 to 51 pounds, average 33 pounds; in strictly residence sections on the average somewhat higher than in business sections. Large proportion of distributing mains too small throughout and gridironing poor in The Bronx, but conditions in the latter borough will be much improved by work now in progress. Sufficient gate valves for fairly good control, but inspection so lax that they are liable to be in unworkable condition when needed. Hydrants generally well spaced, but of decidedly unsatisfactory types poorly maintained.

**Fire Department.**—Well organized on full paid basis. Strength of companies generally good. Number of engines moderate, but deficient in size; generally in poor condition. Ladder service good, though weak in some places; chemical service slight. Fire boats good. Supply of hose and minor equipment fair. Discipline and methods fair. Service as a whole efficient and powerful.

**Fire Alarm System.**—*Manhattan.*—Extremely defective; for details see report of the Committee on Fire Alarm Service, Borough of Manhattan, to the New York Board of Fire Underwriters, September, 1905.

*The Bronx.*—Of manual central office type. Headquarters somewhat jeopardized by inside hazards. Operating apparatus incomplete, necessitating some undesirable methods in transmitting alarms. Boxes largely of antiquated and less reliable type, mostly without keys attached. Distribution generally poor. Circuits overhead.

**Fire Department Auxiliaries.**— Work of fire marshal well performed. Co-operation of police and street departments fair. Assistance of water department and most public service corporations slight. Local alarm systems, watch and patrol services and private fire apparatus all add to the city's protection. Outside aid powerful and accessible.

**Summary.**—Extreme danger of serious shortage before additional sources of water supply are available, with pronounced probability at all times of local failure of supply for combating serious fires, due to generally faulty distribution system and especially to low pressures and unsatisfactory types of hydrants. Fire department powerful and generally efficient. Fire alarm system antiquated, in bad condition and dangerously unreliable.

## STRUCTURAL CONDITIONS AND HAZARDS.

**Building Department.**—Laws comprehensive but inadequate to meet the requirements of a metropolis developing under special conditions of growth, especially as to height, area and protection on wall and floor openings and as to structural iron and steel work. Enforcement generally good on superior construction, but very poor otherwise.

**Explosives and Inflammables.**—Laws and regulations comprehensive, specific and well designed. Enforcement good, as far as it goes; many hazardous conditions exist owing to small force handling situation.

**Electricity.**—Municipality and underwriters enforce provisions of National Code in effect. Inspections by both good. New inside work in very good condition; old, in rather poor condition, but being improved by underwriters. Outside conditions generally good; some conditions in electrical subways dangerous. Electrolysis inappreciable.

**Conflagration Hazard.**—*Potential.*—In Manhattan the potential hazard is present in all built-up portions, varying from a low degree in the higher class residence, in the financial and in portions of the lower west side tenement sections, to an unusually high degree in the entire southeast end of the island and in part of the wholesale drygoods district. It is due to the compactness of the city as a whole, the great heights, areas large of themselves or provided by unprotected openings, narrow streets, large number of conflagration breeding blocks with intervening conflagration "feeding" blocks consisting of weak combustible units, and to the high winds. In The Bronx, the potential hazard is mild, with a few exceptions.

*Probability.*—In Manhattan, the probability hazard parallels the potential in most sections of the city, being high, as a rule, where the potential hazard is high, and vice versa. The wholesale drygoods district is an exception, that portion cited as possessing a severe potential hazard really having a low probability hazard owing to the nature of the stocks, protection and cut-offs and to the watchfulness and general care maintained. In The Bronx, the probability hazard is light.

*Summary.*—The conflagration hazard in The Bronx is unimportant. It has many serious aspects in Manhattan. Features ordinarily inconsequential have here a special significance. The very magnitude of the compactly built territory reduces the effectiveness of what would otherwise be fair fire-breaks. Delancey street, the Bowery, Hudson street, the small parks and squares and similar breaks, effective against bad local fires, would have very little or no effect in such sweeping conflagrations as are possible in Manhattan. Except for Central Park, which would stop a conflagration that did not skirt it, the compact part of the city practically has no fire-stops and is subject to conflagrations sweeping in any direction. Familiarity with this danger and confidence in a fire department of magnificent personnel, even if deficient in modern apparatus and methods, have conspired to foster a sense of security unwarranted by the facts which are that from the standpoint of inherent hazard and values damageable, Manhattan presents a situation which should be alarming to the country at large. In brief, the great average height of buildings; the compact blocks, frequently with bad interior exposures or constituting hollow squares without cut-offs and often with interior structures; narrow streets, especially in those sections where other conflagration elements are most prevalent; unprotected openings, particularly in excess-heights in many important localities; the general inability of the water distribution system to furnish water for third alarm fires and the further weakness of this system in respect to valves and type of hydrants, not to mention its inadequacy as to secondary arteries in important sections; the antiquated and deteriorated alarm system which has recently demonstrated its unreliability, making it certain that otherwise unimportant fires will sooner or later spread; the physical difficulties in the way of a proper handling of fire apparatus; and the high

winds, furnish conflagration conditions which for potentiality and probability combined are perhaps unequalled. The fact should be recognized, irrespective of traditions, prejudices or predilections before it is too late, and well directed efforts put forth to minimize the danger.

An analysis of the city shows that the heaviest value sections are freest from internal hazard, but that they are badly exposed by other sections involving all the elements of the conflagration hazard. The section at the southwest end of the island, while dangerous of itself, is small in extent, and a conflagration there would overcome with difficulty the defenses in the way of fireproof buildings protecting the financial section in which the conflagration hazard is almost absent. The conflagration hazard in the wholesale grocery section is less than is popularly supposed, owing in part to the comparative isolation or accessibility of its dangerous "breeders," and is fairly well cut-off at the lower end by fireproofs, but exposes the high value wholesale drygoods district at the south end of the latter. The entire southeast portion of the island, however, exposes without cut-offs the high value sections nearly the whole length of a long vulnerable side. This southeast portion is of enormous extent, involving a variety of hazards, and so weak structurally as to afford free sweep of almost any general fire well started. Its past immunity from bad fires has encouraged the belief that such immunity will be perpetual. This belief overlooks many important facts which are urged upon underwriters and municipality alike after careful consideration. Water pressures in the territory are very low and large areas are dependent upon 6-inch gridirons, with but few secondary feeders; serious conditions exist owing to the danger of almost total interruption of supply through a break in the arterial system; valves and hydrants in the territory are in poor condition, and the location of the valves is not sufficiently well known to insure rapid action in case of breaks; the hydrants are also of a poor type, and have too small barrels. In addition, conditions above ground do not awaken confidence. The chemicals section, besides the conflagration dangers usual to the construction, block arrangement, narrow streets and frequent unprotected openings of such property, is subject to the hazard of oils and explosives which have, in less favorable situations, demonstrated their capacity for weakening, if not wrecking, surrounding blocks and exposing them to the ravages of fire. The leather section just north is similar in many respects, with individual buildings of even greater height and inherent capacity for damage, while the lower east side tenement district adjoining this adds its quota of hazard. There is no desire to overrate the possibilities of this tenement district, but with large blocks of cheaply constructed risks five and six stories high, inter-exposed, it should at least not be underrated. It is recognized that fires there are generally caught in their incipiency, but conditions are nevertheless ripe for a spreading fire, not only by means of direct exposure, but by flying brands, since the interiors of the blocks contain wooden fences and piles of inflammable refuse, waste-wood, etc., and bad individual fires could start numerous other fires with ease. Much of the above is true, although to a much smaller degree, of the exposure to the high value sections by the west side tenement and manufacturing district.