NATIONAL BOARD OF FIRE UNDERWRITERS
COMMITTEE ON
FIRE PREVENTION AND ENGINEERING STANDARDS

REPORT
ON THE
CITY OF COVINGTON, KY.
(Superseding that of 1936)
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The information on conditions in Covington, Kentucky, was collected in January, 1939, by Engineers Harvey T. Illing, Louis W. Evans, and Charles D. Lehman.

Acknowledgment is made of valuable assistance rendered by the Hon. H. A. Krellmann, Mayor; Theodore Klenmper, City Manager; the officials of the various city departments concerned; the Kentucky Accident Bureau, and others.

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May 22, 1939
COVINGTON, KY.

REPORT No. 168
(Superseding that of 1936)

CITY IN GENERAL

The Commissioners of the commission government are: Hon. J. A. Keuleman, Mayor; William Bevetie, Jr., Carl C. Klise, Henry Meimann, and Frank X. Vadeo. City Manager Theodore Klemmer is administrative and executive head of the municipal government.

Population estimated to be 71,000; the 1930 United States census showed 63,292. The city is located on the Ohio river, opposite Cincinnati. Industries include foundries, machine shops, woodworking plants, the manufacture of electrical apparatus, and other diversified industries. Transportation facilities are good.

The city has an area of 6.5 square miles, a large part of which is closely built upon. Grades are generally slight to moderate, but in some residential districts in the western portion, grades are very steep, a number being 13 per cent. or more. Elevations range from 440 to 500 feet above mean sea level. Street widths range from 30 to 100 feet, being mostly 60 feet. Of the 97 miles of streets, 94 are paved and in good condition; the remaining streets are improved and in fair condition. Bituminous coal and natural gas are the common fuels.

Records of the United States Weather Bureau show that high winds are not frequent and that snowfall comes but slight interruption to traffic. There is practically no continuously severe cold weather but little hot, dry weather. The Ohio river valley flood of January, 1937, inundated about 30 per cent. of the total area of the city to a depth, at places built upon, up to 25 feet. Detailed report on this flood was made by the National Board of Fire Underwriters in March, 1937.

FIREFIGHTING FACILITIES

WATER SUPPLY

OWNERSHIP—The waterworks, owned and operated by the municipality, supply all closely-built parts of the city and a number of smaller communities and individual consumers outside, including the City of Fort Thomas, U. S. Barracks, Ludlow, Fort Mitchell, Kenton Hills, Park Hills, the Latonia Rhythm, and some others.

ORGANIZATION—The waterworks department is under the general supervision of the City Manager and direct charge of the Superintendent of Pumping and Filtration, who also has charge of the equalizing reservoir, John T. Kingrey, who has served in the department about 20 years, and the Superintendent of Distribution, Lewis H. McDonnell, who has served in the department about 8 years. There are 66 regular employees, including 7 at the pumping station, 18 at the filtration plant, 30 on distribution and services, and 11 in the office. Civil service rules have been put into effect; and long terms of service are general.

Records—Plans of the supply works are on file. Good records of pumping and of filter plant operation are kept; recording pressure gages on the distribution system are not well maintained nor are charts regularly filled. Maps and records of the distribution system are being compiled as data are obtained or checked in the field. A map prepared by National Board engineers has been reproduced on an enlarged scale. Valve valves are being numbered on this map, and corresponding valve cards showing locations and details have been about two-thirds completed. The fire department maintains a record of hydrants and cisterns.

Stations—The main office is in the city hall at Third street and Court avenue, with meter shop in the basement; the city garage is at 16th and Russell streets and pipe yards are at the bend of Main street and at 15th and Neave streets.

Fire Service and Emergency Provisions.—Alarms of fire are not received by the water department; they sound in police headquarters in the city hall by regular response is made to fires. All quarters of the department and residences of responsible officials have telephones; the foreman is designated for trouble calls at night, and the superintendent or the assistant superintendent of distribution is called in emergency. Trucks and cars are provided, and definite instructions are issued for assembling crews on short notice.

GENERAL OUTLINE OF SYSTEM.—Supply, taken from the Ohio river, 3½ miles east of the principal mercantile district, is pumped...
through a single force main, with a second main under construction, to reservoir and filtration plants, to these Fluvanna stations, and directly through two supply mains to the distribution system, to which are connected two equalizing reservoirs. All these Fluvanna stations, except the one at James River, supply a high service, with an elevated tank in the northwestern part of the city supplying Paris Hill, and X-street, Hills also. Elevations in this report are in feet above mean

**SUPPLY WORKS—Source.**—The Ohio river furnishes an adequate supply. A dam, 16 miles below the intake, safeguards the supply against extreme low water, which has not fallen below elevation 414; the average annual variation is about 30 feet. Considerable trouble has been experienced with floods or high water, and the original station was shut down for 10 days in 1913. During the flood of January, 1937, water reached an all-time maximum of 7.5 feet over the floor of the present station, or elevation 512, and put the station out of service for 12 days. Work under construction will permit operation of a new pump with water level above the 1937 flood.

**Intake.**—The intake, extending into the river channel from the old station, consists of a tunnel, 138 feet long and 4 feet in diameter, cut in bed rock and brick-lined with cement covering. A masonry casing at the river end contains an iron grating which was recently renewed. The intake from Thomas and the flow from the gravity gate is provided, under the old station, with bottom at elevation 425. The tunnel and pump well were not in regular service or a revolving screen was installed. No recent trouble with ice has been reported.

**Pumping Station—General.**—The original station, containing the intake well, built in 1895, and the present station, built in 1928, are on the west bank of the Ohio river. The main floors of both stations are at elevation 504.5. All steam equipment has been removed. One of the motor-driven pumps is normally operated, and operation is in 3 shifts of at least two men each, under the direct charge of a foreman.

Electric power is received from the Union Light, Heat, and Power Company at 13,200 volts over an single line on wooden poles from the Newport substation; this line also supplies other customers, with connections near Fort Thomas. The distance from the substation to the pumping station is 4.5 miles. The Newport substation, at Lowell and Twelfth streets, is supplied by two feeders, 1.2 miles long, from a steam generating station at Green and Rose streets in Cincinnati, which is connected with the Columbia Park generating station, 18.5 miles down the river. Power is transmitted to the pumping station at 4,150 volts by two banks of three 333-kva., single-phase transformers and by three 10-kv-a. transformers to 240 volts for light and for an electric elevator. The generator is all placed on main floor of the old station. The work in progress provides for placing these transformers and a third bank for the new pump on a balcony at the third floor and driven by a 500-h.p. synchronous motor; both motors have cranks on the same shaft. New electric rating equipment was installed and motors were overhauled after the 1937 flood. Pumps are in a pit, with elevation of center line 436. They take suction from the intake well, ordinarily under head through 18-inch lines which have a cross-connection with a single valve installed. Work is in progress of installing a third pump of 10,000,- 000 gallons capacity to be of deep-well type, to replace the intake well and driven by an extension shaft to a motor to be placed on the floor of a new station.

**Arrangement of discharge piping is being changed.** The two existing pumps in pit will discharge through independent 20-inch leads, equipped with new 15-inch cone valves, to the new 30-inch force main and the new deep-well pump will discharge to the existing 30-inch force main. The two mains are to have a 30-inch cross-connection outside station, with single gate valve provided in this and in each force main just before the connection; a Venturi meter and a 15-inch cone valve will be installed in each line on pumping station side of cross-connection.

**Construction.**—The substructure of the station is a deep, circular, reinforced concrete pit of 35 feet inside diameter and 72 feet deep. An electric crane is installed aild a steel structure is of brick construction; the roof is composition-covered on corrugated-iron on steel beams; the floors are concrete. There are steel lockers and a wood-partitioned office; windows are plain glass in metal frames. The new station is to be of steel frame construction.

**Hazards.**—Power and light wiring is in conduit well installed, and raw and only waste are in metal rails. There is a small coal hoist.

**Protection.**—One chemical extinguisher in pit and one on upper floor. Some small hose and outlets are available. The station is accessible to the fire department only with difficulty.

**Force Main.**—A 30-inch, cast-iron force main, laid in 1897 with a minimum cover of 3 feet, extends west up the hill from the pumping station, according to elevation 812 at the entrance
to the Fort Thomas tunnel, which is 300 feet long and of 8 feet arched brick-lined construc-
tion, thence descending a short distance to the reservoir, 5,150 feet from the station. At the tun-
nel entrance, an open standpipe provides for surge in the line and the escape of air. Pipe is of 3
weights, classified according to the head. Pit-
ometer tests made in 1935 showed the normal
carrying capacity to be reduced about 20 per
cent, due to corrosion.
A second 36-inch cast-iron force main is being
laid from the pumping station to the north basin of
the reservoir, where it has a gated cross-con-
nection to the existing 36-inch force main, which
gates connected to both basins and a direct
cross-connection to the filtration plant. The new force
main is of weights closely corresponding to
Chases B, C, and D of specifications of the
American Water Works Association. It follows a
route generally parallel to the existing main, just
crosses at one point, and is carried
through the Fort Thomas tunnel on cast-iron
saddles above the older main. The new main was
shovel one-half completed at time of inspection, and the remaining pipe was on the ground.

Reservoir.—The reservoir, built in 1889 on the
high ground just above the filtration plant and
about 3 miles east of the principal mercantile
district, is formed by earth dams at the fork of a
ravine, with side slopes and bottoms lined with
stone and concrete. Raw water from the force
main is stored in the two upper basins which are
used for primary sedimentation; the lower basin
has been eliminated, as the filtration plant has
been increased in capacity. The tops of walls of
the two basins are at elevation 856, and the water
level may be carried to within one foot of the
top; between the basins the water elevation is
856, and elevation 780, or the lowest level to
which supply may be delivered to filtration plant.

Filtration Plant.—Completed and put into ser-
vice in November, 1937. Operation is in 3 shifts
of 8 hours each, under the supervision of the
superintendent of pumping and filtration, who lives on the sta-
tion grounds. Three 36-inch lines, one from each basin to the reservoir and one direct from the
force main, connect in a concrete valve chamber just east of the plant, where three electrically-
operated gates are installed, one on each line; supply is normally taken from one of the basins.
From the gate valve chamber, a single 36-inch line,
equipped with Venturi meter and hydraulically-
operated gate valves, delivers supply to a small
mixture tank in the chemical house; a blank
flange has been left in the mixing tank for a sec-
ond line.

From the mixing tank, two 36-inch lines de-
liver water to a pair of coagulation and

sealing basins, and thence over a second weir to
recombination chambers in the basins, from
whence a concrete flame, equipped with sludge-
gate openings to each basin, delivers treated
water to filters. The two basins are normally
operated in parallel, and either may be taken out
of service for repairs or cleaning.

There are 12 rapid-sand filter beds, rated at
1,600,000 gallons a day each, or a total normal
rating of 19,200,000 gallons a day which may be
increased to 24,000,000 gallons with one filter.
Normal flow line of filters is at elevation 726.75.
Filtrated water is delivered to concrete flumes, which
pass the supply over an overflow to the
reinforced concrete clear-water basin under filters.
This basin has a depth at lowest point of
floor of 3 feet and at high water elevation 764.5
a capacity of about 4,500,000 gallons; normal
water level is 762, at which capacity is about
3,500,000 gallons. Two motor-driven pumps, each
rated at 3,500 gallons a minute at 72 feet head,
are on basement floor of filter building; one is
normallly used for top washing filters and the
other for supplying a 2,000-gallon concrete,
wash-water tank placed on a hill adjacent; either
may be used, however, for supplying this tank.
Two centrifugal pumps, rated at 225 gallons a
minute at 227 feet and driven by 15-h.p. motors,
are installed for supplying the U. S. Barracks
at Fort Thomas.

The buildings of the plant are of brick and re-
inforced concrete and of open-pool construction.
The chemical house is high, with provisions for
storage on upper floors; the filter building also
contains offices for plant employees and a
bathroom. Hazards are well guarded, and fire out-
side hydrants are available.

Supply Main.—From the clear-water basin,
two mains, one 36-inch laid in 1889, and one 24-
inch, laid in 1916, with the section nearest the
plant laid in 1931, supply the distribution sys-
tem. They are gated at the basin and also about
about 400 feet below at the Sow, where the 36-inch
is crossed by a pipeline, one foot below the 24-
inch, and thence to Lowell. About 3,000 feet below
the plant they also are gated, with a cross-connection
equipped with a gate and a water-seal; beyond
this point, valve spacing is generally wide. About
1,000 feet below the clear-water basin, supply for the
City of Fort Thomas is taken by a booster
station through connection to both mains, nor-
really from the Michigan supply.)

The 36-inch continues west along the side
slope of a branch of Three-Mile creek and
Backs Road, where it reaches a thrust at a point
1,000 feet from the basin at elevation 694; before it
reaches the Licking river, a 24-inch connection
supplies the Anderson Steel Company plant in
Newport, with a 24-inch closed emergency con-
nection to the Newport distribution system. It
is suspended from the C. and O. Ry., bridge, about
600 feet long across the Licking river and enters
the city at Byrd street, where it continues to the intersection of Greenup and 13th streets, a total length of 2.8 miles. The 24-inch extends in a general westerly direction from the lower connection with the 30-inch and crosses the Licking river on a steel bridge about 1,000 feet long in five spans. This bridge was especially construct-
ed for this main, and space was provided for a future line; the bridge was repaired, scarped, and painted in 1938. The main enters the city at Sum- mit avenue, and its first connection to the distribu-
tion system is at Glen Avenue, 2.8 miles from the plant. Pipes are of Class C, Byr. Breaks have occurred at intervals, but have been less frequent in recent years; space lengths and shoes are located at intervals along the lines. The carrying capacity of the two mains is only about 62 per cent. of the normal capacity according to a Pitometer transit main survey made in 1938, and mains are in need of cleaning; the sum-
mit on the 30-inch main somewhat limits its ca-
pacity.

Equalizing Reservoirs.—These reservoirs of reinforced concrete construction and covered were completed in January, 1927, but due to vari-
ous factors have not been in regular use. They were deferred in the fall of 1926 to be held with-
out water during the winter, as it was stated that under normal conditions the water in them could not be sufficiently circulated to keep it potable. They were filled on request during this inspec-
tion in order to ascertain their value in maintain-
ing a more uniform distribution system at times of high demand. However, the automatic cone regulating or altitude valves could not be made to operate, even on the second attempt, with a water department man in attendance at each valve. The reason was not uncovered on the larger mains in the vicinity of the reservoirs to operate normally the automatic valves if they were functioning properly. The reservoirs are set at somewhat low elevation to act as equaliz-
ers under ordinary conditions, but are of value in maintaining service, if properly operated, during periods of maximum consumption or fire demand, or in case of breaks on either of the supply mains. Each reservoir is equipped with two air and air vent, but neither has an overflow which would give protection in case the automatic valves did not close when called for. The roof of the larger reservoir was partially broken out in July from upward pressure due to faulty or improper operation of valves; the roof was subsequently repaired and put into good condition. Automatic equipment is installed at each reservoir for trans-
mitting water level in the filter plant over tele-
phone lines, but connections have been discon-
tinued. Considering the large investment in these reservoirs and their general value to the system, they should be kept in use at all times and the valves regulated to provide practical reserve. Regular in-
spection of the valves should keep these in good

WATER SUPPLY

condition, and occasional lowering of the water
level should keep the water potable.

The largest reservoir of 3,600,000 gallons capacity is north of 27th street and opposite Warren street; it has a direct 24-inch connection to the 24-inch main in Warren avenue. Floor is at elevation 602 and under side of roof, 712.5, pro-
viding total water depth of 20.23 feet; ordinary high water is at elevation 711. The 8-inch auto-

motive cone valve and the 18-inch gate valve are in a separate concrete vault, which also houses control equipment.

The smaller reservoir of 1,000,000 gallons ca-
pacity is in Devos Park in the northeast corner of the city and connects by a direct 12-inch line about 1,100 feet long to 12-inch main in John street. Floor of reservoir is at elevation 627.5 and under side of roof, 692.5, providing total water depth of 15 feet. Ordinary high water is at elevation 671.5. The 8-inch automatic cone valve and the 12-inch gate valve are in a separate con-
crete vault.

Booster Station and Elevated Tank.—A booster

station has been built on West street at the

city limits and delivers to an elevated tank in

Devos Park, which supplies a small area within

the city, including the Children's Home and also

Benton Hills and Park Hill. Tank is a Dayton

Bond central, rated at 260,000 gallons at 110

pounds pressure and driven by a 20-h.p. 225-volt motor. Pump takes suction through a

6-inch gated connection to a 12-inch main and discharges to the elevated tank. Station floor of small concrete pump house is at elevation 675. The pump operates automatically on a float switch to keep the elevated tank prac-
tically full. The elevated tank has a capacity of

75,000 gallons and is of steel on steel columns, with top of concrete supports at elevation 839. Top of tank is at elevation 924.

CONSUMPTION.—Consumption figures are based on the population of the area served by the ele-

vated tank and the distribution on the 30- and 24-inch supply mains. For the years 1936, 1937, and 1938, the average daily consumption was 2,745,394, 2,732,395, and 2,732,395,000 gallons, which last-mentioned figure for an estimated population supplied of 96,000, in-
cluding about 25,000 outside the city, gives a per cap-
ae use of 90 gallons a day. The Latonia Re-
finery is the largest individual consumer, in 1938 taking an average of 2,470,000 gallons a day; the railroads take less amounts than in former years. The maximum month was August, 1937, aver-
age 12,500,000 gallons a day. The maximum day of recent consumption occurred on August 16, 1937, amounting to 13,660,000 gallons, with a maximum hourly rate on this day between 8 and 9 P.M. of 17,200,000 gallons a day. On January 1, 1938, there were 14,693 active services, all of
which are metered. There are a number of 4- and 6-inch connections for regular consumers, elevator services, and automatic sprinkler equipment.

PRESSURES.—Six recording pressure gages are installed on the distribution system, including 8 at fire stations, one at the city garage, and one on the 16-inch main at the Latonia Refinery; these gages have not been well maintained or charts regularly filed. On January 17, 1938, pressure readings were taken by a National Board engineer at 26 hydrants, well distributed over the system between 9 A. M. and 12:30 P. M.; consumption was at an average rate of 6,000,000 gallons a day, with water level in the closed-water basin at elevation 762. In the principal mercantile district, the average was 93 pounds, with a maximum of 98 and a minimum of 90 pounds. For the whole city, the average was 84 pounds, with a maximum of 100 and a minimum of 48 pounds. Pressure on the high service showed 32 pounds. Pressure showed considerable fluctuations, apparently due in part to sudden drafts from elevator connections. Static pressures under normal consumption indicate a considerable loss in most sections, due to friction or to other causes.

DISTRIBUTION SYSTEM.—As shown on the accompanying map, the system is supplied by two mains, a 30-inch entering the northern section and a 24-inch entering the southern section; a 24-inch artery, passing through the center of the system, with a branch to the larger equalizing reservoir, connects the two supply mains. From the northern terminus, a 26-inch extends north, passing along the eastern limits of the principal mercantile district, and a 24- and 20-inch extends west and north along the western limits of the district; these two mains are connected by a 16- and a 12-inch at the northern end and by a new 12-inch in the southern portion of the district. A 20-inch is laid west and, reduced to 12-inch, supplies Fort Mitchell, Erlanger, and Florence through a meter. A short 20-inch connects to a 12-inch and a new 16-inch, which extend northwest with a 12-inch branch connecting the smaller equalizing reservoir and a 12-inch supplying Ludlow through a meter. From the booster station and elevated tank, an 8-inch high service main extends south with an 8-inch branch to Kenton Hills and a 6-inch to Park Hills. From the southern terminus, a 24-inch extends south, connecting with a 16-inch supplying the Latonia Refinery. With the exception of the last-mentioned main, the arteries have few connections to the smaller mains. Secondary feeders, while somewhat improved, are lacking in most sections.

Minor distributors are largely 4- and 6-inch, with a moderate amount of 8-inch; about 32 per cent. of all mains are 4-inch, and there is still a considerable amount of this size in the principal mercantile district. The gridiron system is weak in many districts due to the large percentage of 4-inch, to the lack of connections to the larger mains, or to long lines of small pipe not cross-connected. There is a total of 123 miles of 4- and 6-inch pipe in dead ends supplying hydrants.

PIPES.—Length and Age.—See Table I. Pipes are tar-coated cast-iron, with the exception of the 12-inch main on Fourth street, the 24- and 16-inch mains to the Latonia Refinery which are of steel, and an old 20-inch on Main street which is wrought iron; 120 feet of the new 6-inch main over the L. & N. R. R. bridge at 26th street is transverse pipe wrapped in hair felt. The first mains were laid in 1920 and are mostly still in use. In some outlying sections, 4-inch has been recently laid for hydrant supply.

TABLE I.—PILES IN THE DISTRIBUTION SYSTEM, January 1, 1938

<table>
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<tr>
<th>Discharge, Inches</th>
<th>Length, Miles</th>
<th>Per Cent of Total</th>
<th>Net Diameter, Inches</th>
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<td>1.5</td>
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<tr>
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<td>...</td>
</tr>
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<td><strong>88.10</strong></td>
<td><strong>100.0</strong></td>
<td><strong>4.70</strong></td>
</tr>
</tbody>
</table>

*Not including levee and supply mains outside of the distribution system.

Condition and Cover.—Old pipe shows excessively heavy incrustation and subincrustation, and a pitometer survey, made in 1935, of 12-inch and larger mains found their carrying capacity materially reduced. Fire flow tests made during this inspection indicate further reduced carrying capacities, with practically no flow available from some old 4-inch lines. A few mains are exposed; breaks have been fairly frequent. Little trouble has been experienced from freezing. Mains in recent years have been laid with a cover of 35 feet and varies between this and 2 feet on older lines. Maximum frost penetration is about 3 feet.

Specifications.—Pipe for the distribution system is purchased under specifications of the American Water Works Association, Class C, or Class 250, for the centrifugally-cast pipe.
Electrolysis.—Some trouble is reported from electrolysis. The 6-inch main on Twelfth street, between Beecher street and Maryland avenue, has been damaged by electrolysis; it has been taken out of service by closing 4 valves, setting up dud ends in the vicinity.

GATE VALVES.—No summary of the number of gate valves available is necessary: they are of various makes. Most of those 20 inches in diameter and all larger are forged and set in brick masonry; others are direct-acting and have the usual iron extension box. The standard direction of closing is clockwise, but a number close opposite. From inspections and records so far compiled, a total of 135 valves, including seven 4-inch, six 6-inch, and two 10-inch with one 4-inch hydrant valve, close counter-clockwise; the boxes of these are painted on the inside to distinguish them in the field.

Location and Spacing.—Valves have been located in most cases on the property line at street intersections; many are set close to intersecting mains. Measurements of locations have been obtained in the field and card records have been prepared of about two-thirds of the system. In the principal residential district, the average length of main that it would be necessary to cut out in case of a single break is 530 feet. In a representative residential district, the average was found to be 630 feet.

Inspection and Condition.—During recent years the larger valves have been inspected annually on an average; the smaller valves have been inspected as other work permitted, and a crew was working on the inspection and recording of the valves in the southern part of the system during this survey. Some of the 20-inch and larger valves have a key placed in manholes; the units are uniform in all cases, requiring no additional attention. According to reports, an inspection of 31 valves from 4 to 20 inches in diameter was made by a National Board of Fire Underwriters engineer with the valve crew. They were in fair to good condition and showed considerable improvement since the last inspections; a few were leaking during operation and leakage on two was stopped with difficulty; one box was filled with dirt.

CLOSING OF VALVES.—The fire department is notified by telephone concerning the operation of valves affecting hydrant supply.

HYDRANTS.—Number and Type.—The fire department reports 880 public hydrants of the post type in service on January 10, 1939; direction of opening is clockwise. Of the total, 751 are of Bessemer steel, 81 of Western, 31 of Corvex, 20 of Louisville, 3 of Welking, and one of Holly. A total of 164 has two 2½- and one 4½-inch outlets, and 49 have three 2½-inch outlets with 6- to 6-inch barred and 6-inch connection to main; 668 have two 2½-inch outlets and 9 have one 2½-inch outlet only, with generally 4-inch bar and 4-inch connection to main. All have gate in branch connection to main.

Location and Drainage.—Hydrants are set at street intersections, with a number in the middle of long blocks. Locations of new hydrants are determined by the distribution superintendent, usually following recommendations of the fire chief. The majority of hydrants have waste-valve openings plugged or do not drain and must be pumped out to prevent freezing.

Inspection and Condition.—The city is divided into 7 districts for hydrant inspection, with districts assigned to fire companies. Hydrants are inspected in the spring and fall of each year, and frequently for freezing in cold weather; those in need of repairs are reported to the water department. Hydrants operated during this inspection were in generally good condition, with some in need of painting or minor repairs, or were excessively stiff. The small flow from some hydrants indicates that auxiliary valves may be partially closed on some hydrants.

Distribution.—The average area served by each hydrant in the principal mercantile district is 50,000 square feet; giving credit for cisterns as hydrants, this is 50,000 square feet. In the total building territory outside the principal mercantile district, the average area served by hydrants and cisterns is 118,000 square feet. Of the 30 hydrants in and bounding the principal mercantile district, 31 have two 2½-inch and one 4½-inch outlets, and 19 have two 2½-inch outlets only.

CISTERNs.—About 12 fire cisterns are in service; these are scattered through the closely-built districts. All are of brick construction and the majority are of 7,000 gallons capacity, with a few larger; all have a 4-inch gated connection to main and 4 have an additional connection.

They are inspected about twice a year by the fire department. Six are located in or bounded the principal mercantile district.

FIRE FLOW TESTS.—See Table 2. Tests were made January 16 and 29, 1939, between 9:30 A.M. and 4:00 P.M. The equalizing reservoirs were full, but automatic valves on them did not operate on either day, although 8 of the tests, including some in which valves were closed or results were questionable, were repeated on the second day after special arrangements had been made in an attempt to get the valves on the equalizing reservoirs to operate. During the tests, the water level in the deep-water basin at the filter plant was at an average elevation of
<table>
<thead>
<tr>
<th>District</th>
<th>Number and Location of Group*</th>
<th>Elevation</th>
<th>Discharge, Gallons Per Minute</th>
<th>Hydrant Capacity</th>
<th>Pressure Drops Per Sq. In.</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Individual Hydrants</td>
<td>Total of Open Hydrants</td>
<td>Hydrant Closed</td>
<td>Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principal</td>
<td></td>
<td></td>
<td>517</td>
<td>1549</td>
<td>1330</td>
<td>1340</td>
</tr>
<tr>
<td>Mercantile</td>
<td>1. Pike and Washington Sts.</td>
<td>512</td>
<td>414</td>
<td>1330</td>
<td>1340</td>
<td>1460</td>
</tr>
<tr>
<td></td>
<td>2. 5th St. and Broadway Ave.</td>
<td>512</td>
<td>414</td>
<td>1330</td>
<td>1340</td>
<td>1460</td>
</tr>
<tr>
<td></td>
<td>3. 5th St. and Scott Blvd.</td>
<td>510</td>
<td>414</td>
<td>1330</td>
<td>1340</td>
<td>1460</td>
</tr>
<tr>
<td></td>
<td>4. 3rd St. and Scott Blvd.</td>
<td>508</td>
<td>414</td>
<td>1330</td>
<td>1340</td>
<td>1460</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>5. 14th and Russell Sts.</td>
<td>515</td>
<td>600</td>
<td>1750</td>
<td>1350</td>
<td>1360</td>
</tr>
<tr>
<td></td>
<td>6. 26th St. and Madison Ave.</td>
<td>515</td>
<td>600</td>
<td>1750</td>
<td>1350</td>
<td>1360</td>
</tr>
<tr>
<td></td>
<td>7. 24th St. and Madison Ave.</td>
<td>515</td>
<td>600</td>
<td>1750</td>
<td>1350</td>
<td>1360</td>
</tr>
<tr>
<td></td>
<td>8. 26th St. and Chilmark Way.</td>
<td>515</td>
<td>600</td>
<td>1750</td>
<td>1350</td>
<td>1360</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor</td>
<td>9. Pike St. and Humus Ave.</td>
<td>513</td>
<td>590</td>
<td>1690</td>
<td>1460</td>
<td>1560</td>
</tr>
<tr>
<td>Mercantile</td>
<td>10. 8th and Main Sts.</td>
<td>510</td>
<td>590</td>
<td>1690</td>
<td>1460</td>
<td>1560</td>
</tr>
<tr>
<td></td>
<td>11. Southern Ave. and McCarney Ave.</td>
<td>510</td>
<td>590</td>
<td>1690</td>
<td>1460</td>
<td>1560</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td>12. 2nd and Kennedy Sts.</td>
<td>506</td>
<td>600</td>
<td>2140</td>
<td>1800</td>
<td>1860</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td>13. 6th and Carroll Sts.</td>
<td>513</td>
<td>170</td>
<td>460</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>14. 5th and Buhler Sts.</td>
<td>515</td>
<td>170</td>
<td>460</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>15. 14th and Russell Sts.</td>
<td>515</td>
<td>170</td>
<td>460</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>16. 10th and Jefferson Sts.</td>
<td>515</td>
<td>170</td>
<td>460</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>17. Gallatin and Eastern Ave.</td>
<td>515</td>
<td>170</td>
<td>460</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>18. 2nd St. and Latahia Ave.</td>
<td>515</td>
<td>170</td>
<td>460</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>19. 3rd St. and McCarney Ave.</td>
<td>515</td>
<td>170</td>
<td>460</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>20. 6th St. and Huntington Ave.</td>
<td>515</td>
<td>170</td>
<td>460</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>21. Highway and Upland.</td>
<td>515</td>
<td>170</td>
<td>460</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>22. Highway and Afton Rd.</td>
<td>515</td>
<td>170</td>
<td>460</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>23. 27th St. and McCarney Ave.</td>
<td>515</td>
<td>170</td>
<td>460</td>
<td>400</td>
<td>480</td>
</tr>
</tbody>
</table>

*Location of groups shown as accompanying plan by corresponding numbers.

762 feet and domestic consumption was at an average rate of 7,500,500 gallons a day as measured by Venturi meters on the supply mains. A few of the tests where the main system had been strengthened showed larger quantities available than in 1936, but a number of tests showed lesser quantities due to lower pressures, to closed valves, or to reduced carrying capacity of mains from further corrosion. With the equalizing reservoirs functioning properly, it is believed that the tests served by larger mains would show somewhat increased quantities, but other tests, due to the weak gridded, would not be affected.

IMPROVEMENTS AND CHANGES—Since the 1936 report of the National Board of Fire Underwriters, the major improvements and changes include the following: At the pumping station, the older pump and electric starting equipment for both units were replaced after the flood of 1937 and both motors have been overhauled; a filtration plant has been constructed in the lower reservoir basin which has been eliminated; two equalizing reservoirs have been built which are, however, not in regular service. A small booster station has been placed in West Covington to supply a new elevated tank which supplies a high-service area in the city and Kenton Hills and Paris Hills outside. A 10-inch emergency connection, to the Newport system has been made which is mainly of value to that city.

The distribution system has been strengthened by 4.7 miles of mains, including three 12-inch lines in the principal mercantile district and a line to West Covington; a few additional connections have been made between large and small mains. A net total of 16 hydrants has been added, and these hydrants are of good type with chrome outlet, and a number of small hydrants have been replaced with this type. Records of the distribution system have been improved and this work is being continued.

Work under construction includes the laying of a second 30-inch force main, which was about one-half completed at the time of inspection. Contract was let in February, 1938, for the construction of a new pump house to contain a third motor-driven pump, with motor and transformers to be placed above the 1937 flood stage. Details of the new force main and changes under construction at the pumping station are described above in this report.
CONCLUSIONS.—Records of the distribution system are incomplete, although being gradually improved. Fire service and emergency operations are fair, although no regular response is designated for second alarms which would be advisable.

Floods on the Ohio river have put the pumping station out of service in the past, but work under construction will permit operation of a new pump in a new building with water at higher recorded level. Piping capacity provides sufficient reserve and section is of fireproof construction. One force main is in service, with a second main of good capacity being completed. The filter plant is of good capacity, but is dependent on a single, short influent line which could be readily duplicated.

The supply mains are of sufficient size, but their present carrying capacity is not sufficient for maximum requirements. This could be considerably improved by cleaning, particularly the 30-inch which also has its flow restricted by the summit over which it is laid.

The new equalizing reservoirs would be of considerable general value to the system if kept in service and cone valves maintained for automatic operation at all times; overflow pipes of adequate size should be provided on each reservoir.

Consumption is normally moderate, but is excessive at times, particularly in the summer. Pressures are excellent in most sections of the city.

Fire flow tests show that under average consumption the required quantity can be delivered to all parts of the district, but pressures of this district the available amounts are insufficient due to small mains and hydrants. Supply in sections of the district recently has been improved by new mains and hydrants. In only four tests outside the principal mercantile district could the required quantities be obtained at pressures suitable for engine supply, and in several of the tests the quantities were seriously deficient; comparison with tests made at the same locations previously indicate further reduced carrying capacities, particularly of 4-inch mains.

The system is mainly well equipped with gate valves, except on some of the large mains. The condition of valves has been improved in recent years, and this work should be carried on with regular inspections.

The large majority of hydrants are too small and these should be replaced, particularly in high-value sections. Spacing and condition are generally good.

FIRE DEPARTMENT

ORGANIZATION.—Beaufit—Full paid since 1894; on two-platoon basis since 1917.

Supervision.—The department is under the general supervision of the city manager.

Officers.—Chief Frank A. Noyce, age 52, was appointed to his present position in 1930 after serving 10 years in the department, mostly as master mechanic. Assistant Chief William B. Salyers, age 34, was promoted in 1937, after 6 years in the department, part as acting lieutenant.

The chief is the executive head of the department with nominal control over men and apparatus; the assistant chief has charge in the absence of the chief.

Membership.—Total 75, consisting of 2 chief officers, superintendent of fire alarm, assistant superintendent of fire alarm, inspector, master mechanic, drillmaster, 8 captains, 2 lieutenants, 12 engineers, 3 operators, 1 secretary and 42 firemen.

Expenses.—The average annual maintenance expense for the fire department, including the fire alarm system but excluding hydrant and traffic signal maintenance, for the past five years has been $145,220. During this time $23,512 was spent for apparatus, equipment and hose. In the year ending December 31, 1930, salaries amounted to $140,832, and general expense to $14,109; this was a 4 per cent expense for maintenance of $2,182, based on an estimated population of 71,000.

Appointments and Promotions.—All appointments and promotions are made by the city manager from lists of eligible prepared by the civil service commission. The age limit is 21 to 50 for original appointments, and all applicants must be able to read, write and speak the English language. While not provided for in the law, new employees must pass a physical examination and serve a six-month probationary period before appointment becomes final. Promotions are based entirely upon suitable written examinations.

Retirement and Pensions.—A pension fund, established by State law, is maintained by the city manager from lists of eligible prepared by the civil service commission. The age limit is 21 to 50 for original appointments, and all applicants must be able to read, write and speak the English language. While not provided for in the law, new employees must pass a physical examination and serve a six-month probationary period before appointment becomes final. Promotions are based entirely upon suitable written examinations.

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Members can only be discharged or demoted for cause after trial.
Companies.—Organizations—See Table 3. Five engines, 2 hose, 1 combined hose and ladder, and 1 ladder company are in service in 6 stations. Company officers are assigned to both shifts of 2 companies at headquarters, and to one shift only of outlying stations. Engineers are assigned to each piece of pumping equipment; most of the members can drive and a member has been trained to operate the pumps.

### TABLE 3—FIRE COMPANIES—LOCATION AND EQUIPMENT

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Mem. on Duty</th>
<th>Apparatus Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng. 1. A.</td>
<td>Headquarters (Sixth St., Washington Ave.)</td>
<td>4</td>
<td>1000-gal. Pump*</td>
</tr>
<tr>
<td>Hose 2...</td>
<td>[Parkway and Albert Sts.]</td>
<td>3</td>
<td>Hose Wagon</td>
</tr>
<tr>
<td>Hose 3...</td>
<td>With Engine 1</td>
<td>2</td>
<td>Hose Wagon</td>
</tr>
<tr>
<td>Eng. 4...</td>
<td>With Engine 1</td>
<td>2</td>
<td>750-gal. Pump</td>
</tr>
<tr>
<td>Eng. 5...</td>
<td>[Sycamore St. and 17th St.]</td>
<td>3</td>
<td>1000-gal. Pump</td>
</tr>
<tr>
<td>Eng. 6...</td>
<td>[Southwest St.]</td>
<td>3</td>
<td>750-gal. Pump</td>
</tr>
<tr>
<td>Ladder 1...</td>
<td>With Engine 8</td>
<td>3</td>
<td>130-gal. Pump</td>
</tr>
<tr>
<td>Lad. 1...</td>
<td>With Engine 8</td>
<td>3</td>
<td>130-gal. Pump</td>
</tr>
<tr>
<td>Lad. 2...</td>
<td>With Engine 8</td>
<td>3</td>
<td>130-gal. Pump</td>
</tr>
<tr>
<td>Lad. 3...</td>
<td>With Engine 8</td>
<td>3</td>
<td>130-gal. Pump</td>
</tr>
</tbody>
</table>

*Equipped with Turnout Fins. (Pretents) in Company located in area near High Valley District.

*Equipped with Ladder Pipes.

Maintenance.—The department, excepting the inspector, master mechanic and 3 operators, is divided into two platoons, working alternate 24-hour shifts. Members are allowed two weeks' annual vacation, 3 being permitted off a shift at a time during the summer months. Off-shift members are subject to call and have residence telephones or telephone addresses. Permission is required to leave the city with not more than 3 permitted out at a time. The off-shift has not been called recently, but good response would be expected. Continuous watch is maintained by the operators at headquarters, but none do not even sleep near telephones in other stations.

Distribution.—Headquarters, with an engine, a hose and an aerial ladder company, is on the edge of the principal mercantile districts, and 3 more engine companies are within one mile. Most of the city is within one mile of an engine or a hose company. The ladder service in the Linn and Rosedale districts, south of 26th street, is good from the ladder-ladder company, but the remainder of the city, except West Covington, is dependent upon the aerial truck at headquarters, which is unsuitable for long runs to the outlying districts.

Equipment.—Pumpers.—See Table 3. Two 1500-gallon, multiple piston type and three 750-gallon, 2-stage, parallel-series centrifugal type pumpers are in service; all are of Aln basement type, have relief valves or pressure regulators and carry hand and soft sunction, large water tanks, and 12-foot roof and 24-foot extension ladders.

Pumper Tests.—All pumpers were tested at draft by a National Board of Fire Underwriters' engineer during this inspection; all delivered over their rated capacities at satisfactory pressures, and were fairly well operated.

Hose Wagons.—See Table 3. Two hose wagons equipped with chemical tanks are in service; and a hose wagon, loaded with 1,200 feet of 2 1/2-inch hose and carrying two ladders, is in reserve. All are of Aln basement make, 17 to 24 years old, with only 4-cylinder motors and 2-wheel brakes, and are in questionless condition to meet the demands of modern fire service.

Ladder Trucks.—See Table 3. A SEagrave, 75-foot spring-suspension aerial ladder truck and an Aln basement 80-foot city service type ladder truck carrying hose, water tank and 250-gallon booster pump, are in service. These truck carry 9 and 8 ground ladders, respectively, including extension type and those with roof hooks. The aerial truck is 15 years old and, although recently rebuilt by the manufacturer, is in fairly good condition; the other truck is new.

Chief's Car.—Miscellaneous Vehicles.—Fuel.—Chief officers are each provided with a coupe, equipped with police radio receivers. The master mechanic has an old coupe and light trucks are provided for shop and fire alarm use. An ambulance is used for rescue and mercy calls.

Gasoline is stored in underground tanks at 4 stations, fired with inside pumps. Fuel is supplied at overhead hose in city stations; carried in the shop truck, or by a commercial tank truck on call.

Hose.—Cotton-jacketed, rubber-lined hose is purchased under the usual trade guarantees; after use it is dried on a rack at Station 8 or on hoses and sidewalks at other stations and is stored in rolls. It is replaced on carriages monthly if not used at a fire and tested annually at 350 pounds pressure. 48 per cent. all on出lying companies, is over 5 years old. Each hose consists, including the city service truck, carries 1,500 feet of 2 1/2-inch and 200 to 300 feet of 1 1/2-inch cotton-jacketed, rubber-lined hose, with nearly complete spare skins in quarters, and 200 feet of French rubber hose for booster and chemical streams.
### SUMMARY OF APPARATUS

<table>
<thead>
<tr>
<th></th>
<th>In Service</th>
<th>In Reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pummers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000-gallon</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>750-gallon</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Hose Wagens</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Ladder Trucks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12'</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Service, with Hole Tool, Tank and Banister Pump</td>
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<tr>
<td>Chiefs' Automobiles</td>
<td>2</td>
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</tr>
<tr>
<td>Ambulances</td>
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<td>Mechanics' Automobiles</td>
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<td>Steep Truck</td>
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<tr>
<td>Hose, 3-in.</td>
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</tr>
<tr>
<td>Hose, 2-in.</td>
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<td>0</td>
</tr>
<tr>
<td>1½-in. Fire Hose</td>
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</tr>
<tr>
<td>1½-in. Fire Hose</td>
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</tr>
<tr>
<td>Ladders, Total Length</td>
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<td>100</td>
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<td>Ladders, Short on Hose Connectors</td>
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<tr>
<td>Water Tanks</td>
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</tr>
<tr>
<td>Gas Meters</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Safety Cams</td>
<td>17</td>
<td>4</td>
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<tr>
<td>Portable Turrets</td>
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<td>2</td>
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<tr>
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<td>2</td>
</tr>
<tr>
<td>Dockets, etc.</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Stairs and Wye Connections</td>
<td>4</td>
<td>0</td>
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<tr>
<td>Ladder Pipe</td>
<td>3</td>
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<tr>
<td>Collier Pipe</td>
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<td>0</td>
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<tr>
<td>Distribution Boards</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Special Adapter for National Standard and Couplings</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

### Repairs
- Maintenance of apparatus is in charge of Master Mechanic Hubert D. Fumegan, age 43, an experienced automotive mechanic who was appointed to his present position in 1931, after 2 years in another city department; he is assisted by immigrants to needed. Work is done in a poorly appointed room in the rear of headquarters station; there is a fair layout of hand tools and a few space parts in stock. Apparatus must be returned to the builders at Cincinnati or Columbus, Ohio, for general overhauling or repair.

### Painting
- Pummers are tested at draft yearly from Primrose's Lake in Devon Park.

### Fire Station
- The station is housed in six story buildings of ordinary construction; headquarters is overcrowded with four or five vehicles using 3 stories, and must station have room for additional apparatus. Two are fairly new, the one in Roselle having been built within the last year, and are in good condition; others are old, in only fair condition and poorly arranged for the service, with hand-opened doors, steam heat and lack of suitable hose drying facilities.

### Operation
- Discipline: Rules and regulations, adopted in 1930, are out of print. General orders are issued as needed and posted in stations. The chief is given authority to enforce discipline; he may relieve any member from duty for cause and proper charges to the city manager, who, after a hearing, can fine, suspend, demote or dismiss, subject to review by the civil service commission. Discipline is only fair; there have been few formal cases of disciplinary action in recent years.

### Drills and Training
- There is no drill tower, the informal drills being held at fire stations or other available buildings. Drillmaster Frank Koch, age 43, has received training at several State fire schools; he is unable to devote sufficient time to drills, since he is frequently required to act as a company officer. Occasional company drills are held each spring and fall at stations with apparatus and equipment and company schools are held at stations at other times.

### Drills and operations observed during this inspection were fair, though the most for intensive training program at a well equipped drill tower.

### Response to Alarms
- The usual response to all alarms, except for definitely known minor fires, is use engine, one hose and one ladder company to the principal mechanic and surrounding industrial, minor mercantile and residential districts. Elsewhere, one ladder and two engine or hose companies respond, except that ladder service is in the Roselle and West End districts when the ladder truck is out of service. In West Covington the ladder truck responds only on special call. Definitely known minor fires are usually responded to by the nearest engine or hose company, the chief officer on duty responds to all but some minor fires.

A list of boxes on station walls shows locations normally responded to at first alarm; maps show company districts. Response to extra alarms or other fires is largely handled by the operator and chief calling for help by telephone, with few prearranged plans for a complete running card; an excessive moving of companies is practiced, even on some first alarms. Second
alarms are usually handled by Covington companies but a third, or general, alarm would get into operation a co-operative aid schedule between this city, Newport and about a dozen nearby towns and villages whereby some companies move into Covington stations to be piloted by off-shift members and protect other areas of the city, or conversely to the fire, if needed; all movements are directed by telephones or in some cases by police radio, so Covington's and Newport's fire alarm systems are not tied together and the running card does not satisfactorily provide for extra alarms.

Response of an engine or an engine and the ladder-box company is made under contract to the villages of Park Hills and Westen Park; such response accounted for 4 of the 10 runs out of the city in 1916, the other being to assist neighboring communities.

The surfaces of the city is fairly level except west of Western avenue and up to 27th street from the south, where steep grades, partly unpaved, would impede the movement of fire apparatus. Principal streets to nearly all built-up sections of the city are paved and in fair to good condition. There are few important rail-road crossings at grade, but a number of the minor streets or overpasses are so steep as to hamper the movement of heavy apparatus. Heavy traffic and parking interfered with response in congested areas, and overhead wires cause considerable obstruction to ladder work in closely-built sections.

Fire Methods.—Extensive use is made of 1-inch and 2-inch chemical streams or the 1 1/4-inch leader lines supplied from the pumps on pumpers or hose and ladder truck on exception. Direct hydrant streams are used. Large hose is laid from the hydrant to the fire and usually is used in supply pumps feeding smaller lines; for longer fires, the pumper returns to the hydrant and connects usually with small or soft stream. Small, shut-off nozzles are generally used, along with some fog nozzles and other special or heavy stream appliances when needed. Little use has ever been made of spraying and sprinkler connections. Ventilation is practiced. Effort is made to keep water damage to a minimum and considerable salvage work is done, such as covering contents and cleaning premises of debris and soot and smoke before leaving.

Inspections.—No effort is made to familiarize firemen with structural conditions, through the medium of building inspections. Firemen inspect hydrants each spring and fall and daily during freezing weather.

Reports and Records.—Journals are kept at all fire stations, and the power captain at a fire makes a report to headquarters, which is followed up by the inspector and the secretary to get further data. Secretary John B. Thompson keeps a fire loss record and makes an annual report on the department's operations, under the direction of the chief. Records are also kept of apparatus, expenses and personnel.

CHANGES.—Since the 1916 report of The National Board of Fire Underwriters, 2 old 1,000-gallon pumps and 2 hose trucks have been replaced by 3 new 750-gallon pumps and city service type ladder truck carrying base water tank and booster pump. Also, the fire station on Southern avenue, Latonia, has been replaced by a new building across Tibbetts street, and the station on Twelfth street abandoned, moving Hose Company 3 to headquarters. Ladder service has been improved in the Latonia-Edgewood district, but operations have deteriorated due to the inadequate training program and the discontinuation of building inspections by firemen.

CONCLUSIONS.—The fire department continues to be under good leadership, but is deficient in ladder companies, and hose wagon should be replaced with pumpers. Existing companies are under-equipped and undermanned, especially at night. Minor equipment and special stream appliances are lacking in a number of important items and, while the hose supply is nearly adequate, drying facilities are poor and there is no Intouch box. Those conditions are somewhat offset by a fairly good cooperative aid arrangement with nearby communities. Operations at present are handicapped by lack of an intensive training program as a well-equipped drill tower, and of frequent inspections of buildings by all firemen to familiarize them with structural conditions. Response to alarms is deficient and no provisions are made on the running card for handling response to extra alarms.

FIRE ALARM SYSTEM

ORGANIZATION.—The fire alarm system is a part of the fire department, and is maintained by Superintendent of Fire Alarm John B. Achley, age 53, assisted by Claude E. Remley, age 42. These men work on opposite platoons and when not engaged in fire alarm or trouble signal work, they respond to fire alarms usually in a chief's car. These men have had 15 and 8 years experience, respectively. A well equipped truck is provided for fire alarm work.

HEADQUARTERS.—Apparatus is located in a small inside room on the second floor of fire department headquarters, a 2-story building of ordinary construction, with severe unprotected parapet on one side, while the broad canopy is nearly protected. The building is of a type not suitable for fire alarm service, and is not properly located.
FIRE ALARM SYSTEM

EQUIPMENT.—Apparatus at Headquarters.

—Apparatus is of Canonsville make and automatic type; it consists of a 10-circuit battery control board and a 10-circuit automatic repeater.

Current Supply.—Current for operating the system is supplied by duplicate batteries of lead and acid type storage cells, mounted on glass panels on porcelain knobs on wood racks in a small room behind the apparatus room. Batteries are charged on alternate days by either of two motor-generator sets. Batteries appear to be in good condition; there is a good supply of extra jars, plates and electrolyte.

Circuits.—Nine all-metallic, normally-closed box circuits, with a total length of about 608 miles, of which 75 per cent, is underground, are in use. The underground construction consists of No. 14 rubber-insulated, copper wires in 2- to 20-circuit lead-shielded cables in telephone company ditches. The aerial construction is No. 10 copper wire, most of which is hard-drawn with weatherproof insulation, all carried on util- ity or city poles; part of the poles carry power or street light wires, but efforts are made to stay well below these. Box heads form underground construction are cables in ducts from the nearby manhole to the box on a pedestal; aerial lines extend down the pole in conduit with weatherproof head from the cross-arm or bracket to the box. Circuits enter private premises to four boxes and cross private property in a few other cases. Three of the nine box circuits do not connect to instruments in some fire stations.

Circuit headboards stations in 2 cables extending up the outside of the building, to a terminal box on the roof, thence in conduit down to the basement and boardroom, to enter stations underground from nearby manholes or terminal poles. Only a short conduit to instruments. Circuits appear to be in fairly good condition with few grounds.

Circuits are protected at the control board by 3½-amperere string fuses, at the terminal box on the roof of headquarters by 5-amperere open string fuses, and by 1-hour cut-out cutting switches, all for most fire stations and at junctions between aerial and underground construction by 4-amperere open string fuses and vacuum type lighting arresters. Batteries are protected by an overload, reverse current, reverse voltage, and 3½-amperere open string fuses on the racks. While box leads on poles carrying power wires do not have insulating cases, all boxes and lighting arresters are grounded.

Apparatus at Fire Stations and Elsewhere.

—Each fire station has a large gong, punch register, and automatic light switch on a box circuit. There is a special 12-blow box and telegraph key at the telephone switchboard. There are also a register and gong in the chief's residence; a register in police headquarters, and a gong in the office of the Union Light, Heat and Power Company.

Boxes.—Description.—There are 156 boxes, of which 17 are private including 5 that are inaccessible to the public; all are of Canonsville make. Three, located at fire stations, are of the plain interlocking type and others are of accession type. An additional box, used for transmission of special signals, is located at headquarters. Sixteen of the 17 master type private boxes are connected to auxiliary stations on 23 automatic sprinkler system valves. There are 53 boxes that are mounted on pedestals, 81 on poles, 17 on building walls and 5 in buildings; 2 of the newer boxes have quick-acting doors, while the remainder have keys under guard. Boxes are painted red with yellow bands around poles; they have not been repainted in the last year and are dingy and rather unsightly; none has a light to indicate its location at night.

Boxes inspected during this survey were in only fair condition. One box failed to function, a spring broke in another, and irregular operation was noted in several others; they were timed to send signals at 1½ to 1½ seconds between blows.

Distribution.—Box distribution is generally good in and near the principal mercerite district, and good to only fair elsewhere. It is estimated that about 30 additional boxes are required for adequate protection.

TELEPHONE SYSTEM.—A private telephone switchboard is located in a booth at the front of the apparatus room at fire headquarters' change it has 4 lines from the public exchange, one from the police switchboard and one from the American Protection Company, and has direct lines to each fire station, the chief's office and 2 other places in headquarters station. There are provisions for instantaneous communication to stations, but this feature is not used for handling fire alarms.

OPERATION.—Routine and Maintenance.—The superintendent of fire alarm and his assistants are on duty alternate days. When not engaged on fire alarm or traffic signal maintenance, they respond to fire alarms; one sleeps each night at headquarters fire station. Three operators, working on 8-hour shifts, maintain continuous watch at the telephone switchboard; women are normally available if needed.

Circuits are tested four or more times daily for voltage, current strength and grounds. Batteries are examined weekly for cell voltage and electrolyte. Single test blows are sent by the operators.
over the system twice daily from a telegraph key in the special box near the telephone switchboard. Boxes are usually inspected and operated through the silent test switch twice monthly. Fairly good plans and cards showing details of circuits are kept, but other records are vague or lacking.

Alarms Transmission.—Four rounds of box alarms are automatically transmitted over the system. Telephone alarms are received by the operator on watch and are relayed to the responding companies individually after two rings on the telephone system to all stations after this, remaining companies are advised of blaze out of quarters. Telephone alarms are not confirmed over the fire alarm system. Verbal alarms received at any station are relayed to headquarters where they, along with those from the American Protection Company or the police department, are handled as telephone alarms.

During 1958, there were a total of 483 fire alarms, of which 61 were received over the fire alarm system and the remainder by telephone, 152 of which were known to be of minor nature and received reduced responses. There were also 478 special calls for rescue or ambulance service.

The Covington operates, in addition to handling alarms for the communities where the Covington fire department responds under contract, receive alarms from Fort Mitchell and South Port Mitchell and operate the centrally-controlled alarm to summon the volunteer fire department; their indication is transmitted by Covington operators to learn the location of the fire.

CONCLUSIONS.—The fire alarm system continues to have a number of features of unreliability, the most outstanding of which is the hazardous housing for the incomplete headquarters' apparatus and the lack of duplicate alarm circuits to Covington. A good portion of the existing circuits are underground but endangered daily by the lack of proper circuit protection. Boxes are largely of good type but improperly maintained and inscriptions. The lack of a transmitter at the telephone switchboard, whereby telephone alarms can be confirmed over the fire alarm system, precludes the proper handling of these calls. Tests and records are incomplete. Early efforts should be made to improve the maintenance until it is possible to provide adequate headquarters apparatus, securely housed.

FIREFIGHTER AUXILIARIES

FIRE MARSHAL.—The duties of State fire marshal are placed with the Fire Prevention and Safety Section, in the Division of Insurance, with the Department of Business Regulations. Sherman Goodspeed is the Director of Insurance and

D. P. Vanderlin is Supervisor and ex-officio State fire marshal; Harold Nielander is the local deputy fire marshal.

The State law requires the chief of the fire department to investigate the cause of every fire and to make a written report to the Division of Insurance within 10 days; immediate report must be made in case of suspicious fires. Further investigation is made by those of suspicious origin.

The fire marshal and his deputies have the authority to enter buildings, cause arrests, summon and compel the attendance of witnesses, take testimony under oath, and punish for contempt; the evidence thus secured must be supplied to the prosecuting attorney.

POLICE DEPARTMENT.—Chief Alfred Soild. Total membership, 64.

Equipment.—One patrol, 6 automobiles, and 4 motorcycles, usually with side cars, are in service from one station in the City Hall. A police signal system, consisting of 68 weatherproof telephones, with vibrating recall bells, is connected by 32 lines to a private switchboard in police headquarters; the system is owned and maintained by the Citizens Telephone Company, Inc., using usual telephone circuits. The automobiles carry receivers tuned to the Cincinnati police main transmitter.

Fire Service.—Fire alarms are received on a punch register or by direct telephone line, and are then relayed for broadcast over the Cincinnati police radio transmitter, with instructions for at least one squad to respond. Patrolmen on beats respond to nearly fires as part of their regular duties; further assistance is called, if needed. Police inspect new building construction for permits.

Traffic Conditions.—Traffic lights are located at about 32 important street intersections; those in and near the principal mercantile district can be set red in all directions and bells sounded by the fire alarm operator to facilitate the movement of fire apparatus. Important traffic arteries are usually "truly streets." Street cars usually stop and automobiles, trucks, and buses generally move to the curb upon the approach of fire apparatus.

There are a few railroad grade crossings in shopping districts, the more important lines having been elevated or the streets underpassed, some of which are too narrow for big apparatus. Heavy traffic and parking offer considerable obstructions during rush hours.

PUBLIC UTILITY.—The Union Light, Heat and Power Company, supplying gas and electricity, receives alarms by a group of 6 fire alarm circuits or by telephone and the Cincinnati police radio broadcast, and a trouble crew responds to
all alarms to handle gas and electric services and street car trolley wires.

TELEPHONE SERVICE.—The Citizens Telephone Company, Inc., an affiliate of the Cincinnati and Dayton Bell Telephone Company, serves about 12,000 telephones in or near the City of Lexington through a 9,800-system exchanges located in a 2-story building of fireproof construction; it is outside the principal mercantile district, with protection in a slight exposure and the usual protection to internal hazards. Circuits with standard telephone protection are generally in cables, which are underground in most closely-built sections.

Three trunk lines in one group, listed for fire emergency calls, but used for all fire department traffic, extend on the switchboard at fire department headquarters. An additional line is provided from the operator’s switchboard to fire alarm headquarters, which is used to complete calls for which the subscriber has dialed the operator to report a fire; these special calls are supervised and recorded. During 1908, about 82 per cent. of the 493 fire alarms were received by telephone, although some were also received by a fire alarm box at about the same time.

CENTRAL STATION WATCH SERVICE.—The American Protection Company maintains central station night watch and fire alarm service for 17 subscribers and sprinkler supervisory service for one. The office is on the first floor of a 3-story building of ordinary construction with protection against severe exposures, located in the principal mercantile district. Signals are received on double pan resistors, lights and bells, and are transmitted to the fire department over a direct telephone line from department switchboard.

PRIVATE FIRE PROTECTION.—There are about 29 automatic sprinkler systems in the city, 25 of which are supplied to 16 major type fire alarm boxes. There are various amounts of other fixed fire appliances, including fire pumps, hydrants, standpipes, hose, and extinguishers.

OUTSIDE AID.—In an emergency, substantial outside aid is readily available as the result of a cooperative aid arrangement with about 12 nearby cities, towns and villages, the largest of which is Newport, Kentucky, across the Lehigh river. Powered help is available from Cincinnati, Ohio, across the Ohio river, on an hourly charge basis.

STRUCTURAL CONDITIONS AND HAZARDS

BUILDING DEPARTMENT

ORGANIZATION.—Supervision.—An ordinance of 1904 provides for a building inspector in the Department of Public Finance, who an inspector has been appointed. The building code makes the sanitary code, under the Board of Health, also provided for in the ordinance of 1904, responsible for its enforcement. The responsibility is divided among the city commissioners for an indefinite term. Duties include the inspection of building operations and the enforcement of building regulations, also the supervision of construction for the city.

Personnel.—G. Edward Reinsle, an experienced building, was appointed sanitary guard May 1, 1904. He has no assistants.

Permits.—A permit must be obtained before proceeding with building operations. Applications are made on a form requiring an outline of proposed construction and must be accompanied by plans and specifications, except those for work of minor importance.

Inspections and Records.—Building operations are usually inspected four or more times depending upon the importance and nature of the work. Contractors are advised of violations verbally and in writing and inspections are enforced by suitable means, including prosecution, if necessary. The police cooperate in reporting unauthorized construction.

Applications, copies of permits, plans and specifications are filed by serial numbers with index by owner’s names in the inspector’s office in the city hall, a 3-story building of ordinary construction within the principal mercantile district.

BUILDING LAWS.—There are no State laws regulating building construction, but the Fire Prevention and Rules Section of the State Division of Insurance has promulgated “Standards of Safety” which contain good regulations regarding theaters, schools, churches, halls, factories and other buildings of assembly and detention, as well as chimneys and heating apparatus and fire exits. All cities are required to establish sufficient fire limits within which frame construction must be properly restricted. Enforcement facilities are inadequate.

The municipal building regulations are, for the most part, contained in the building code; this code was adopted in 1904, and there have been few important amendments. The building ordinances contain some good features relating to fire protection but are inadequate or lacking in many important respects, particularly as to limitations of heights and areas, requirements for protection
to exposed window, party wall and floor openings, for private fire protection and restriction of frame construction within the fire limits.

Roof Coverings.—The State "Standards of Safety" require that, within the corporate limits, all new buildings must have incombustible roof coverings, and existing wooden shingle roofs, when damaged more than 25 per cent, must be repaired or replaced with incombustible coverings. However, a city ordinance passed on April 14, 1935, permits the use of approved edge grain wood shingles as roofing material on certain buildings, including dwellings and buildings of frame construction, located outside the fire limits.

Fire Limits.—These are shown on the accompanying map. They include the principal mercantile district and considerable surrounding territory. Written these limits, the reconstruction of frame buildings damaged by fire or other cause, is not properly regulated; however, frame buildings within the fire limits, when seriously damaged, are usually condemned.

Enforcement.—The building regulations of the city are sufficiently enforced, but this is by no means a cause for complacency as these regulations are seriously deficient in fire protection design. Little attention is paid to the State regulations.

LOCAL CONDITIONS.—The principal mercantile district consists of 20 blocks or parts blocks containing 390 buildings. Twelve buildings, covering 11 per cent of the built-up area, are of fireproof construction; of these, ten have unprotected vertical openings, or are without fireproof walls. The others are of steel frame construction. The largest are a 4- to 7-story sprinklered department store of 13,200 square feet and a 6-story office or hotel building. The largest are a 3-story school building, under construction, of 14,500 square feet, the department store noted, and a 4-story sprinklered mercantile of 11,000 square feet area. Floor openings are protected in 2 of these buildings exposed windows are protected in 3 others.

Two hundred and forty-three buildings, covering 12 per cent of the built-up area, are of ordinary construction. Two sprinklered warehouses of 8,500 and 7,600 square feet area are 6 and 5 stories in height, respectively, and a warehouse of small area is of 7 feet, but no other building of this class of construction exceeds 4 stories in height. Some buildings are of excessive area, the largest of which are a 4-story freight house of 24,500 square feet, the 3-story city hall of 18,000 square feet, the 3-story YMCA of 13,200 square feet, and a 2-story office and mercantile building of 10,600 square feet area. Sixteen buildings are of large area and unprotected or inadequately protected communicating openings form or incite large and excessive areas in several cases. Floor openings are protected in 11 buildings; exposed openings are protected in 6.

The 29 buildings and 23 sheds and additions of frame construction over 7 per cent of the built-up area. The largest is a portion of a spring blended machine shop having an area of 11,000 square feet. All others are of small area and none exceeds 2 stories in height.

Of buildings of all classes, a considerable number haveustry or fire walls, many of which are 4 inches and a moderate number, more than 4 inches too light in whole or in part. Parapets are almost invariably low and frequently lacking. Fire escapes, usually of the conventional stair and balcony type, were found on most of the buildings requiring fire escapes. Fourteen buildings, excluding two of frame construction, covering 11 per cent of the built-up area, are equipped with automatic sprinkler supply from city mains, giving an effective protection.

CONCLUSIONS.—The building laws contain some good features but are inadequate or lacking in most of those relating to fire protection. The fire limits are sufficiently exclusive. By local ordinance, slunged roofs are permitted outside the fire limits. Structural conditions have improved but slightly in recent years and buildings of the predominating type are still fire-relatively weak.

EXPLOSIVES AND FLAMMABLES

ORGANIZATION.—Supervision.—A State law of 1935, as amended, establishes the former Department of Fire and erects a Section of the State Division of Insurance. The State Insurance Commissioner and his deputy, including the chief of the fire department, have supervision over the handling and storage of explosives and flammable, with authority to enforce the provisions of the law. The chief of the fire department and any member of the fire department designated by him are required to inspect all buildings and premises, except dwellings, at least semi-annually; within the fire limits, inspections must be quarterly. Written reports of each inspection must be filed. The chief of the fire department and the county board are authorized to enforce the municipal ordinances regarding fire prevention. These officials are named previously in this report.

Permits.—Regulations of the State Division of Insurance require that a permit be obtained for the storage of any substance considered a practical fire or accidentally all construction, process or occupancy involving ex-
ELECTRICITY

 Explosives and flammmables. Permits may be issued only after inspection and approval by a deputy fire marshal or the fire chief.

 Inspections and Records. A captain in the fire department is permanently detailed to inspection work; other members of the fire department make no inspections. In closely built districts buildings are inspected about once a month; else

—where, inspections are made about four times a year. When hazardous conditions are found, verbal or written notices to make corrections are issued. These are followed up and corrections secured by similar means, including prosecution, if necessary. Notes on hazardous conditions found are filed by date at fire headquarters; no other records are kept.

 LAWS AND REGULATIONS. By State law, the Fire Prevention and Safety Section of the State Division of Insurance is given the power to fix and order such reasonable standards for construction and maintenance of buildings as shall render them safe from fire loss. The Standards of Safety for the State of Kentucky, covering the manufacture, sale, storage and transporta.

—tion of explosives and flammmables and other features of fire prevention were adopted in 1929 and revised in 1937. These are in accordance with the regulations recommended by The National Board of Fire Underwriters. Enforcement is left to the local fire departments under the supervision of the division.

 By State law, fire prevention must be taught in public and private schools.

 Municipal ordinances regulating explosives and flammmables, while including a number of safty good provisions, are, for the most part, obsolete and have been entirely superseded by the State regulations which latter are used exclusively by the local authorities in their work.

 LOCAL CONDITIONS. A hardware dealer in the principal mercantile district has one 25-

—pound carbon tetrachloride compound and blasting powder in a covered metal box in a shed in rear of premises, and at times has larger quantities of explosives for immediate delivery; but orders for explosives in quantity, are usually filled di-

—rect from manufacturers outside the city. No high explosives were found in the principal mercantile district and none is manufactured or stored within the city.

 Bulk stocks of paints and oils in paint and hardware stores are usually kept in barrels or drums with gravity draw-off through faucets, thus leading to hazardous conditions of floors and aisles; a few dealers have suitable tanks with pumps for at least a portion of the storage. There is one paint factory in the principal mercantile district, located in a small area, twenty buildings of ordinary construction; oils and other flammmable liquids are kept in covered metal tanks of several barrels capacity; promissories are kept in good order, but the plants form a severe exposure to nearby buildings.

 Gasoline at garages and filling stations is stored in properly arranged underground tanks. Most of the garages are located in busy buildings of ordinary construction or the equivalent, but a number of the older of construction are 2 stories in height; heating facilities, in general, are not properly arranged.

 There are two dry cleaning establishments in the city. Both have fairly well arranged cleaning rooms, but off or detached. Cleaning fluid is stored in underground tanks to which washers are arranged to drain, but contains drain to open tanks, so that at times there are excessive quantities of cleaning fluid in above ground con-

—tainers. Both establishments use the least volatile cleaning fluid.

 Buildings and block interiors, with few exceptions, were found to be free of hazardous accumulations of rubbish.

 In one wholesale oil station, tanks are entirely underground and properly arranged. In the others, tanks are generally well constructed and supported, but a few have unprotected metal supports. Piping is usually above ground and subject to injury. Most of the tanks are without adequate vents, thus increasing the local hazard. Most stations are well insulated or form moderate mutual exposures with nearby construction, usu-

—all important.

 CONCLUSIONS. State regulations regarding explosives and flammmables are in accordance with those recommended by The National Board of Fire Underwriters. Municipal ordinances have a number of good features, but have been superseded by the State regulations. Inspections by an officer detailed from the fire department are fairly effective and local conditions are fair.

 ELECTRICITY

 ORGANIZATION AND CONTROL. By agreement with the lighting company, the Cincinnati branch of the Ohio Inspection Bu-

—reau supervises all new inside wiring in the city. An electrical inspector of the bureau makes all electrical inspections in the city and vicinity.

 Contractors must secure the bureau of each installa-

—tion. Inspections are made as frequently as necessary before work is completed and on completion. The lighting company does not supply current to an installation until it has been approved. There is no systematic inspection of old work except in connection with reported changes and extensions or on complaint of the fire department officers. When hazardous conditions in old wiring are found, written notices to make correc-
tions are issued; these are followed up and cor-
corrections secured by suitable means including dis-
connection of service if necessary. Records of
the inspection bureau are complete and well
maintained.

LAWS AND REGULATIONS.—The build-
ing code requires all wiring to conform to the
National Electrical Code. The inspection bureau
requires wiring to consoy in this code before
certificate of approval is issued.

INSIDE WORK.—A number of representa-
tive equipments were inspected to ascertain the
quality of supervision maintained and the gen-
eral condition of wiring for light and power. In
the new work, estimated to have been in service
an average period of 2 years, an average of 1.4
defects per equipment was found; the more re-
cently completed had few, if any, defects, indi-
cating efficient supervision; other equipments,
while showing good original work, are now
slightly defective, largely due to the misuse of
flexible cord, but in part due to changes made
since approval and to unsatisfactory maintenance.

In the old work inspected, an average of 2.2
defects per equipment was found. Most of the
old equipments were found to be in fair condi-
tion but a few were in poor to hazardous con-
dition, indicating the need of systematic rehaus-
tions. About onethird of the defects were due to
the misuse of flexible cords; other defects most
frequently found were: The use of lines of
excessive capacity, the use of unapproved devices
and materials, as well as defects due to unsatis-
factory maintenance and use.

OUTSIDE WORK.—The Union Light, Heat
and Power Company supplies current for light-
ning and power. Electricity at 13,239 volts from
substation at Union is transmitted by overland lines to substations in
Lovington, Newport and Fort Thomas, where it is trans-
formed and distributed by 4,500 volt distribution, in series
for the series transformer street lighting systems, at a nominal 6,000 volts and
by 550 volt direct current for street railway
and trolley bus operation. The 4,500 volt distribution is stepped down, usually at poles, but in a few cases by
transformers in vaults to 120 volts for light-
ing and 240 and 700 volts for power. A few con-
sumers are supplied with 4,500 volt current. The
Cincinnati, Newport and Covington Railway Company
utilizes the 550 volt direct current systems of
the overhead trolley with rail return.

Main lines of the telephone company are un-
derground in the principal mercantile and other
heavily built districts, but other wiring is practi-
cally all overhead and forms considerable ob-
servation in most of the streets and alleys of the
principal mercantile district and vicinity.

ELECTROLYSIS.—The gas division of the
lighting company, the telephone company and
the superintendent of fire alarms report no recent
electrolytic damage, but the water department
reports damage to a main and some damage to
services. Trains of the street railway system are
well loaded and provided with return fenders.

Systematic tests of returns are made.

CONCLUSIONS.—An ordinance requires all
wiring to comply with the National Electrical Code. The Ohio Inspection Bureau, through an
agreement with the lighting company, has good
control over new work, which is well installed.

There is no systematic inspection of old work
and, while most of the old equipments were found
in fair condition, a few were in poor condition
indicating the need of systematic reinforced
work. Outside wiring in the principal mercan-
tile district is largely overhead and forms con-
siderable obstruction in most of the streets and
alleys. Some recent damage due to electrolysis is
reported; the street railway company employs
extensive measures to eliminate ground current.

CONFLAGRATION HAZARD

PRINCIPAL MERCANTILE DISTRICT.—
Limits.—The district is bounded by Fifth, Scott,
Seventh, alley east of Madison, Eighth, alley west
of Madison, Seventh, Washington, Eighth, C &
O tracks, Russell, alley north of Pike, Washing-
ton, Sixth, Crawford alley, Fifth, a line 120 feet
west of Madison, Fourth, alley west of Scott and
Greenup, Park place, Court and Fifth streets.

The district is in the northeastern part of the
city, crossing sources of water from the vicinity of
the south bank of the Ohio river a distance of 6
blocks or 2,000 feet, and is 2 to 3 blocks wide. It
includes 20 blocks or part blocks and covers 41.5
acres, of which 22 per cent. is in streets. Values
are with few exceptions, moderate or low. The
district is practically level; streets are paved and
in good condition. Exposures are moderate from
surrounding older mercantile and residential dis-
tricts.

Two of the blocks are of large area, but the
others are of small or moderate size. Practically
all are wholly or partially divided by 16-foot
alleys or open spaces so that accessibility is
good. Several blocks in the southern portion of
the district are compactly built upon, but most of
the blocks have considerable open spaces of
the total block area, 31 per cent. is not built upon.

Two streets, for the length of one block each in
the district, are 100 feet wide; most of the longi-
dinal streets are 60 feet and cross streets 30
feet in width. Of the total length of streets, 35
per cent. are 50 feet or less and only 4 per cent.
80 feet or more in width.
Buildings of essentially fireproof construction, covering 11 per cent. of the occupied area, are situated in 8 blocks; these buildings, on account of location and lack of vertical opening and window protection, are only of some value as local fire stops; full value is afforded only in the few instances in which construction is of a standard type. Frame construction covers 7 per cent. of the occupied area and is found in most of the blocks, in several of which it contributes somewhat to the general hazard.

The remaining construction is ordinary of a type lacking in fire-resisting features. Only the buildings, both of which are sprinkled, are of excessive height and only a moderate portion of the area covered by this class of construction is in large or excessive areas; but party and fire walls are usually of insufficient thickness, partitions are almost invariably low and frequently lacking and unprotected vertical and window openings are the rule. The low heights tend to lessen the potential hazard, but on account of the poor integrity of many of the fire walls and the predominance of mutually exposing buildings of inferior construction, the hazard is high in many of the blocks; however, due to the prevalence of small areas and the considerable amount of open space in most of the blocks, the hazard for the district as a whole is moderate.

The probability of fires beyond control is favorably affected by the fireproof and sprinkled construction, but in many of the blocks, where grouped buildings of inferior construction are mutually exposing, there is great likelihood of several buildings being involved in one fire. The alleys, while affording good accessibility, are so narrow the fire is likely to spread through them or the comparatively unprotected windows. Sprinkled construction covers only 11 per cent. of the built-on area and other private fire protection equipment is small in amount. Overhead wire obstructions are considerable in most of the streets and alleys. The water supply, while somewhat inadequate, is fairly reliable. The fire department is understaffed, under-trained and lacking some equipment, but substantial outside aid is immediately available through a system of cooperative response. Extending fires are probable in most of the district, but such fires should be confined to the group or block of origin.

The block in which the hazard is most pronounced is bounded by Washington, Pike, Russell, and alley north of Pike (Sanborn, page 20, block 2). A 2-story extensive area wholesale liquor house of ordinary construction and a 4-story paint factory with a frame addition, together with a high, extensive area church across the alley, are mutually exposing through generally unprotected or inadequately protected windows and either possibility of serious fires involving adjacent 2- and 3-story mercantiles and dwellings.

OUTSIDE THE PRINCIPAL MERCANTILE DISTRICT.—Manufacturing and Warehouse Districts.—Mainly along the rivers and the railroads, but also in other localities, are several lumber yards and woodworking establishments, foundries, machine shops and other industries. Most of the plants are fairly well isolated or in small groups and a number, including several of the more extensive, are sprinkled. There is little fireproof construction and many buildings are of excessive area, so that serious group fires are probable, but such fires should not involve any large portions of these districts.

Minor Mercantile Districts.—Along portions of the boundary of the principal mercantile district and extending along W. Pike street northwest from the principal mercantile district, a distance of about 5 blocks, and southwest along Madison avenue, a distance of 2 blocks, also in Latonia at the intersection of Southern and Dev. Counter avenues, are minor mercantile districts consisting of mainly 2- or 3-story, small-area buildings of ordinary construction with a moderate amount of frame. As heights are low and accessibility good, fires should not involve more than a small group of buildings.

Other Districts.—The residential districts consist mainly of brick and frame dwellings, with a number of warehouses, manufacturing plants and small minor mercantile districts interspersed. Wood shingled roofs have been largely eliminated, so that the flying brand hazard is no longer serious in any extensive locality.

Conclusions.—In the principal mercantile district, fire-resistant wood construction, lacking in window protection, makes serious group fires probable. The water supply is somewhat inadequate and the fire department is under-manned, under-trained and lacking some equipment, but substantial outside aid is immediately available. As prevailing heights of construction are low and areas small, the probability of fires involving large portions of the district is only moderate.

In the minor mercantile, manufacturing and warehouse districts the hazard is local. In the residential districts the hazard is not severe in any extensive locality.
RECOMMENDATIONS

Recommendations marked with a star (*) are deemed of most importance and their early adoption is urged.

WATER SUPPLY

Records

1. That the detailed survey of the distribution system and the card index record of gate valves be completed, sectional plate of the system be prepared on tracing cloth, and summaries of essential data be kept; and that the recording pressure gages be maintained and charts filed; also that records be kept of the water level in the clear-water basins and equalizing reservoirs.

Supply Works

2. That at the pumping station the work under construction, including the installation of the third pump with motor and transformers to be placed on floor of new station above flood level, be completed as soon as practicable.

3. That at the filtration plant, a 30-inch emergency line be laid around the valve chamber and connected independently to the mixing tank.

4. That the equalizing reservoirs be kept in service and the core valves on them be set for automatic operation; in this connection that the core valves be inspected and tested weekly or given sufficient maintenance to assure their functioning properly at all times and that overflows be provided on each reservoir.

5. That the supply mains be cleaned, to be followed by the cleaning of 10-inch and larger mains of the distribution system.

Notes

6. That the distribution system be strengthened by the installation of the mains listed in the table below and shown in red on the accompanying map.

7. That a general strengthening of the distribution system be brought about by replacing 4-inch mains in sections where fire flow is inadequate, by eliminating dead ends wherever practicable, and by cross-connecting large mains more frequently to distributors; it is recommended that the following be adopted as the standard minimum sizes of mains used for hydrant supply for all future construction:

a. For residential districts, 8-inch; 6-inch to be used only where it replaces a good grifferon and in no case in blocks 600 feet or more in length.

b. For mercantile and manufacturing districts, 8- and 12-inch; the former to be used only in sections where they replace a good grifferon, and the latter for long lines not cross-connected.

8. That the detailed inspection of all valves be completed as soon as possible, to be followed by regular annual inspections with records of inspections and operation filed; in this connection, that the stems of all valves operating opposite from the standard be changed to conform to the standard.

9. That hydrants installed in the future have 4-inch gated connections with the main, not smaller than 6-inch valve, and one 4½-inch and two 2½-inch outlets.

10. That hydrants in service having barrels or branches 4 inches or less in diameter be replaced according to the foregoing specifications; this substitution to be made immediately in important mercantile and manufacturing districts, and in other districts according to a well-defined plan by which all such would be replaced within a reasonable time.

FIRE DEPARTMENT

Organization

11. That an additional assistant chief and sufficient company officers, so that one will be on
duty with each shift of each company, be pro-
vided.
12. That civil service rules be revised to pro-
vide lower age limits, along with educational re-
quirements, definite height and weight limits for
original appointments, and consideration of merit
and fidelity for promotions.
13. That members be retired from active duty
at the age of 62 years, unless unusually efficient.
14. That the normal strength of the depart-
ment be increased by:

- Immediately adding sufficient men so that
there will be 5 men on each shift of each
high-value company and 4 men on other com-
panies, except that the ladder-company should
have at least 6 men.
- Eventually adding sufficient men so that the
least number on duty at any time, including va-
cation periods, will be:

<table>
<thead>
<tr>
<th>Company and Arrangement</th>
<th>Day</th>
<th>Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Companies 1 and 4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Company 3 changed to an engine</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>
| Ladder Company 7, and Re-
gine Company 6, changed to a
ladder-pump company | 8   | 12    |

15. That the pumpers with Engine Company 6
be replaced with a ladder truck carrying a 750-
gallon pump, 1,000 feet of 2½-inch hose, and a
100-gallon water tank; the present pumper to re-
place the hose wagon with Hose Company 2 in
West Covington.

16. That the hose wagon with Hose Company
3 be replaced with a 750-gallon pumper.

Hose

- That pumpers carry at least 200 feet and
hose trucks, 500 feet of 3-inch, with at least 1,000
feet of 2½-inch and 1-inch hose, with a complete
spare shift in quarters, and the reserve hose truck
carry 1,000 feet of 3-inch hose; all hose to be
laced with 2½-inch couplings, properly beaded.

18. That stations be provided with more suit-
able hose-drying facilities.

Equipment

- That the following equipment be provid-
ed, where not already available:
  a. To hose carriers: Breast hose jacket, gas pack,
     hand lights, hand pump case, hose shut-off, hy-
     drostatic hose gauges, and salvage cutters.
  b. To ladder trucks: Auger, collar pipe, gener-
     ator with flood lights, hand pump, ladder straps,
     life belts, life net, oxygen helmets, saw, siamese,
     squeegees, and yoke.

Operation

20. That an adequate shop with test circuit be
provided.

21. That a complete book of rules be com-
plied, published, and distributed to all members,
and be regularly revised.

22. That a well-equipped drill tower be pro-
vided and that the training program be intensi-
ﬁed with more frequent drills and regular com-
pany and department schools.

23. That a complete running card be arranged,
providing for 3-hose response to all boxes and
with definite provisions for extra fires, moving
in to be reduced or eliminated and operations to
include local details of the cooperative aid ar-
rangements with nearby cities and towns.

24. That monthly inspections of all build-
ings, except residences, be made by department
members to familiarize the men with structural
conditions; such inspections to be recorded by
suitable notes and sketches and used for discus-
sion in company and department schools.

FIRE ALARM SYSTEM

Headquarters

25. That headquarters be removed to an inde-
based, ﬁreproof building or to an addition to a
fire station of ﬁreproof construction and with
all communications and exposed openings prop-
erly protected. All apparatus to be on incombust-
ible masonry and no unnecessary combustible
permitted in the building.

Appliances

26. That the existing equipment be remod-
elled and that additional features be provided as
follows:

At Headquarters:
  a. Electric terminal and circuit protection facili-
ties.
  b. Circuit supervisory equipment.
  d. Time stamp.

At Fire Stations:
  e. Tagger and register on some box circuit
and going on the recommended alarm circuit,
with provisions for transferring the register to the
alarm circuit.

20
CIRCUITS

27. That the reliability of service be increased by:
   a. Continuing the practice of placing circuits underground whenever possible.
   b. Removing circuits from poles carrying high-tension wires.
   c. Providing duplicate alarm circuits to all fire stations.
   d. Extending every box circuit to an alarm instrument in some fire station.
   e. Rearranging circuits so that they will not connect to more than 30 boxes or 5 fire stations, except that circuits entirely underground may connect to as many as 30 boxes.
   f. Providing adequate protection to circuits at headquarters, at fire stations, and at junctions between open wire and cable, either aerial or underground.

BRAZES

28. That additional boxes be installed so that a box will be visible from and within 500 feet of every building in high-value districts and within 300 feet of every building in other closely-built sections; boxes and pedestals or a portion of the supporting pole to be painted signal red annually, and those boxes in important districts to be indicated by special lights at night.

29. That boxes be retimed to transmit signals at not more than one second between blows.

OPERATION

30. That a systematic plan of tests be developed, whereby each box shall be examined, cleaned and tested by allowing to transmit over the circuit weekly and after electrical storms, and whereby the system shall be tested twice daily by the transmission of two or more consecutive blows; complete records to be kept of all tests, troubles and operations.

31. That telephone alarms, except for definitely known minor fires, be confirmed over the fire alarm system by transmitting the nearest box number after notifying the nearest company by telephone. Extra alarms for various fires to be handled over the fire alarm system in connection with the recommended running cards, copies of which are to be kept at each fire station.

BUILDING DEPARTMENT

32. That the building code be amended to conform to modern requirements for construction and fire prevention as given in the “Building Code Recommended by the National Board of Fire Underwriters,” especially as to limitations of heights, areas, and frame construction within the fire limits, protection to floors and window openings, and requirements for chimneys and heating apparatus, wall thicknesses, private fire protection and roof coverings.

ELECTRICITY

33. That authority be provided for the reinspection of old wiring, correction of defects and subsequent reinspection of all wiring at suitable intervals.

34. That a definite plan be adopted for the removal of overhead wires in closely-built sections so that eventually all obstructions to fire department operations will be eliminated.

CONFLAGRATION HAZARD

35. That owners of existing defective constructed buildings which are so located as to form conflagration areas, be required to suitably protect floor, party wall and exposed window openings.

36. That automatic sprinkler equipments, with outside flameless hose connections and controlling valve near main in street, be required in all buildings which, by reason of their site, construction or occupancy, singly or combined, might act as conflagration breeders.
City in General.—Population about 75,000. Industrial and residential city across Ohio river from Cincinnati. Grades slight in business and mass of residential sections; outlying portions quite hilly. Streets of fair width; practically all paved. High winds, snowfall, but dry weather and periods of continuous cold weather all infrequent.

Water Supply.—Municipal ownership. Recent improvements. Supply from Ohio river raised by motor-driven pumps of good capacity, at prestation station, through force mains to raw-water reservoirs; delivered through single line to raw filtration plant of adequate capacity with relatively small clear-water basin. Two supply reservoirs of good size, but with reduced capacities, deliver by gravity to the distribution system to which are connected two new equalizing reservoirs not in regular service. A small booster station and elevated tank supply a small high service. Consumption normally moderate. Pressures generally excellent. Main arteries fairly secondary feeder system incomplete; gridiron poor and old mains tuberculated. Valves generally well spaced; condition fair and being improved. Hazards mostly of small type, although recent installations good; spacing generally good. Improvements at pumping station under construction.

Fire Department.—Full paid; en Z-platoon basis. Appointments and promotions under Fair Civil Service regulations. Position provisions; no compulsion requirement age. Insufficient officers and companies undermanned, especially at night. Number of house and engine companies adequate, but hose wagons should be replaced by pumps; ladder service incomplete. Hose supply nearly adequate except for lack of 4-inch hose; tested but poor drying facilities. Small stream service fairly good. Minor equipment and special stream appliances lacking some important items. Fire stations mostly old and poorly arranged. Repair facilities poor. Discipline lax; rules out of print. Training program incomplete; no drill tower. Negresses to worst deficient and loosely arranged. Fire methods good for small fires. Building inspections by firemen discontinued. Records fair.

Fire Alarm System.—Automatic system. Headquarters equipment incomplete and hazardously housed. Circuits with good portion underground but no separate alarm circuits and 3 box circuits without gaps in some fire stations; client protection poor. Station apparatus incomplete. Boxes usually of good type but improperly maintained; distribution good to fair. Telephone alarms improperly handled. Tests and records incomplete.

Fire Department Auxiliaries.—State fire marshal with adequate authority. Police cooperative with fire and building departments. Public utility renders all at all fires. Telephone service widely distributed and used considerably for transmitting fire alarms. Private alarm services and fire protection of value to local plants. Substantial outside aid readily available.

Summary of Fire Fighting Facilities.—Water supply works mainly adequate and reliable; fair to good quantities available in principal mercantile district, elsewhere quantities generally inadequate. Fire department undermanned, especially at night; deficient in ladder service; personnel undertrained. Fire alarm system only fairly adequate and with many features of unreliability.

Building Department.—Laws have some good features, but are inadequate or lacking in many essential requirements. Enforcement generally good. Fire limits satisfactorily extensive; by local ordinance, wooden shingled roofs permitted outside. General structural conditions fire-resistively weak.

Explosives and Flammables.—State regulations good; municipal regulations inadequate. Police enforcement by fire department. Local conditions fair.

Electricity.—National Electrical Code adopted. Undertakers have good control over new work through co-operation with lighting company; no systematic inspection of old work; some of which is in hazardous condition. Outside wiring forms considerable obstruction. Some recent damage due to electrocution; preventive measures employed.

Confederation Hazard.—In the principal mercantile district, fire-resistively weak construction and serious group fires probable. The water supply is somewhat inadequate; but the fire department, though lacking in men and some equipment, with the substantial outside aid immediately available, should be able to contain a fire in the group of blocks of origin.