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GREENSBORO,
NORTH CAROLINA

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

REPORT
ON THE
CITY OF GREENSBORO, N. C.

(Superseding Previous Reports)

FIRE DEPARTMENT

have only a 4-inch branch connection and about 60 per cent have no gate in the branch connection. Hydrants are regularly inspected and kept in good condition. Spacing is only fair.

CONE MILLS CORPORATION WATER WORKS.—The Cone Mills Corporation Water Works supply water to the residential areas surrounding the four large mills of this corporation which are located in the northeast section of the city. Population served is about 15,000. The system is under the direction of the mill management, with the plant operation supervised by the engineering department. Dan McConnell is Plant Engineer. System maintenance is done by the central maintenance department. Robert Gregory is Superintendent of Filter Plants.

Three closed connections are provided with the city distribution system, two 12-inch connections to a 10-inch and a 6-inch main and a 6-inch connection to an 8-inch main of the mill system.

About 20 well distributed boxes are connected to the city fire alarm system and each mill has its private fire brigade and water supply system.

Supply from Richland Lake, 4½ miles north of the city with 1,860,000,000 gallons storage is pumped through a single 20-inch line 4½ miles and supplements supply through connections to Buffalo Lake, White Oak Lake and Revolution Reservoir. Buffalo Lake with its own watershed of 3½ square miles and 300,000,000 gallons storage at elevation 764 is the supply used for the system supplying the residential areas. From a concrete intake tower in Buffalo Lake, a 16-inch line extends under the dam to two 14-inch lines with a connection to the 20-inch pipe from Richland Lake, to the sedimentation basins and five 800,000-gallon rapid-sand filters. Piping is so arranged that the lower levels of water in Buffalo Lake can be delivered to the sedimentation basins by pumping. Low-lift pumping equipment consists of two electric motor driven pumps of 1,000,000 and 2,000,000 gallons a day capacity and a gasoline driven 3,000,000-gallon pump. From the filters the water is delivered to two 500,000-gallon clear water reservoirs with connections to the suction well under the pump room. High lift pumping equipment includes three electric motor driven pumps, one 2,000,000-gallon and two 1,180,000-gallon and a gasoline driven 3,000,000-gallon pump. The station is a large area building with adjoining filter plant. It is unexposed, with electric wiring in conduit and some private fire protection. Electric power is delivered to the station over a single overhead circuit. Operation is continuous with more pumps being added during daytime consumption.

Equalizing storage is provided by a 50,000-gallon elevated tank and a 300,000-gallon stand-pipe with overflow elevation of 921. Both are located at Fairview Avenue and Meadow Streets.

The average daily consumption during 1950 was 3,040,000 gallons with a maximum one-day consumption of 4,009,000 gallons.

Discharge pressures at the pumping station with gage at elevation 749 range from about 72 to 112 pounds according to the number of pumps in operation. Elevation of the water in the tanks has little effect on the discharge pressures indicating serious friction losses in the distribution system between the tanks and the pumping station. Pressures taken on four well separated hydrants during fire flow test indicated an average pressure of 64 pounds ranging from 43 to 96 pounds.

The distribution system is shown on the accompanying map. Two 12-inch force mains extend to the northwestern section of the distribution system. From this point a 12-inch line extends eastward to the White Oak Plant area, reducing to 8- and 6-inch pipe. Another 12-inch main reducing to 10-inch and eventually to 8-inch, supplies the central and southern sections of the mill villages and also the two tanks on Fairview Street. There are 21.15 miles of mains in the system of which 60 per cent is 4-inch, 16 per cent 6-inch, 10 per cent 8-inch, 7 per cent 10-inch and 7 per cent is 12-inch. Minor distributors are free from dead ends, but are made up largely of poorly supported small pipe with wide gridironing. Gate valves are inspected and during the past 2 years, about 35 new valves have been added.

There are about 100 fire hydrants, mostly of Columbian make and with two 2½-inch outlets. A few newer hydrants are of R. D. Wood make and have an additional 4½-inch outlet. The average area served by hydrants is excessive necessitating the use of very long hose lines.

Fire flow tests shown in Table 2 were made on January 19, 1951; about 110 pounds was maintained at the pumping station and the equalizing tanks were drawn down about 15 feet.

Conclusions.—The source with large storage is considered dependable. Filter capacity is adequate, but pumping equipment is without adequate reserve capacity; this condition is partially offset by the closed emergency connections with the city system. The distribution system is inadequate to carry the heavy consumption demands and, in general, adequate supply for fire department pumpers cannot be obtained.

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ORGANIZATION.—**General.**—The fire department, full paid on a 2-platoon basis working an 84-hour week, is under the general supervision of the city manager who is appointed by the council for an indefinite term with removal at its discretion. Chief C. W. Wyrick, 45 years of age with 24 years service, was appointed chief in

1946 and is in full charge of the department with responsibility for its discipline and efficiency; he is a capable and progressive officer. Assistant Chiefs M. D. Barnes, age 61 and F. G. Garrard, age 59, were appointed to their present positions in 1940 and 1946 and have been members of the department for 34 and 26 years respectively.

Membership.—The total membership is 101 with a fire force of 86. See Table 3.

TABLE 3.—MEMBERSHIP.

Chief	1
Assistant Chiefs	2
Captains	20
Driver-Operators	23
Privates	40
FIRE FORCE	86
Drillmaster	1
Mechanic	1
Clerk	1
Superintendent of Fire Alarm	1
Fire Alarm Repairmen	2
Telephone Operators	3
Fire Prevention Division	6
TOTAL	101

Expenses.—During the 5 fiscal years ending June 30, 1950 expenditures for maintaining the fire department and fire alarm system averaged \$281,698. During the last fiscal year it was \$305,691 including \$273,986 spent for salaries; this is an expense of \$4.15 per capita based on a population of 73,703. During this same period a total of \$250,519 was spent for new equipment.

Appointments and Promotions.—There are no civil service rules to govern appointments. Members are appointed by the city manager upon recommendation of the chief for indefinite terms; removal is for cause only and subject to appeal to the city council. Minimum height and weight limitations are prescribed, appointees must be between the ages of 21 and 28 years of age, and a high school education is required; a one-year probationary period is specified. Promotions are made by the city manager upon recommendations of the chief.

Retirement and Pensions.—A pension system is provided under a state plan whereby 4 per cent is deducted from members' salaries and an equal amount is contributed by the city. Retirement is optional at 55 but no compulsory retirement age is provided; retirement for disability not service-incurred is permissible after 10 years service. Annual physical examinations are no longer required. A Firemen's Relief Fund, supported by a tax on foreign fire insurance premiums, pays sick and death benefits and the State Firemen's Association maintains an insurance fund which provides death benefits by assessment on each

member. Salaries are continued during sickness or injury incurred on duty and the city carries workmen's compensation insurance on each member.

Companies.—See Table 4. Eight engine, 2 ladder and 1 squad companies are in service in 7 stations. Each company has a captain in charge of each shift; regular drivers and operators are assigned to each shift on each piece of apparatus and all but the recently appointed men are qualified as relief. Members are divided into 2 platoons working alternate 24-hour shifts. All are allowed 12 days vacation and 5 days for holidays which may be taken as 3 days added to vacation and 2 days when available manpower permits. Members are required to get permission before leaving the city on days off and must report to fires if called; all members are required to have telephones at their residences and the numbers are on file with the telephone operator at headquarters.

Two engine and the 2 ladder companies are located north of and adjacent to the principal mercantile district and within $\frac{3}{4}$ mile of all points in the district. All points in the city are within adequate response distance of engine companies but a high value textile mill area in the northern section of the city is up to 3 miles and a large college for women is over $1\frac{1}{2}$ miles from the ladder companies at headquarters.

APPARATUS AND EQUIPMENT.—**Pumpers.**—See Table 4. Two 1,000-gallon and six 750-gallon pumpers are in service. A 1916 model American-La France 750-gallon pumper, equipped with 1,000 feet of 3-, 100 feet of $2\frac{1}{2}$ - and 150 feet of $1\frac{1}{2}$ -inch hose and some minor equipment, is in reserve at headquarters; when necessary it responds on call to large fires. A pumper with a 500-gallon pump on a 1942 Chevrolet chassis, purchased from the Federal Government as surplus in 1946, is in reserve at Station 6. It is equipped with a 250-gallon water tank, 1,500 feet of $2\frac{1}{2}$ -, 200 feet of $1\frac{1}{2}$ -, and 200 feet of $\frac{3}{4}$ -inch hose and some minor equipment.

The 7 older pumpers were tested during this survey to determine their condition and the ability of the operators. The reserve 1916 pumper delivered only 64 per cent of capacity with excessive pump slippage and could not maintain 250 pounds pump pressure while operating in pressure gear with all gates closed. Engine 7 delivered only 94 per cent of capacity with a high pump slippage while operating with the throttle in full open position. All other pumpers delivered rated capacity at adequate pressures but pump slippage was high in 2 cases. Operators were generally good, showing proficiency in operation and familiarity with pumping procedure.

Ladder Trucks.—See Table 4.—One aerial and 1 service ladder truck are in service and 1 aerial

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and 1 service ladder truck are in reserve. The reserve aerial ladder truck, a 1920 American-La France, is equipped with a 70-foot aerial ladder and carries, in addition, 10 other ladders totaling 232 feet, and some minor equipment. The reserve service truck, a 1924 American-La France, is equipped with a booster pump and a 90-gallon water tank with 200 feet of 3/4-inch hose and carries 10 ladders totaling 207 feet including a 45- and two 35-foot extension ladders; it is well-equipped with minor equipment including a 1,000-watt d-c generator, 2 flood lights, a power saw, an oxyacetylene cutting torch, an inhalator and a portable turret.

Squad Truck.—See Table 4. An International truck equipped with a 350-gallon front-mount pump is in service. It carries a portable 1,250-watt d-c generator and floodlight, a foam generator with 200 pounds of foam powder, an aspirating nozzle with 5 gallons of foam liquid and other minor equipment.

Other Apparatus.—A 1930 Dodge 1/2-ton panel truck responds on call manned by men from headquarters companies; equipped as a salvage truck, it carries an asbestos suit, 26 salvage and counter covers and much minor equipment. A 1950 Ford 1-ton truck carries complete life saving and first-aid equipment including a trailer designed to transport 2 metal outboard motor powered boats or an iron lung, a portable 1,000-watt a-c generator with floodlights, portable electric saw and electric hammer, 2 portable oxyacetylene cutting torches, 2 inhalators, 4 resuscitators, a portable iron lung and 3 oxygen tents. It responds on call, usually manned by 1 or 2 firemen from headquarters companies while the telephone operator notifies life saving and first-aid volunteers when required.

Chief's Cars—Other Vehicles—Fuel.—A 1951 Pontiac and a 1946 Chevrolet 4-door sedans are provided for the chief and assistant chiefs respectively; the assistant chief's car carries a resusci-

TABLE 4.—FIRE COMPANIES—LOCATION AND EQUIPMENT.

Company	Location	Paid Members on Duty	APPARATUS		HOSE			Ladders Carried	Booster Tank Gallons
			Make and Type	Put in Service	Size, Inches	Carried Feet	Spare Feet		
Eng. 1hv	Headquarters: {Greene St., near Bellemeade St.}	5	{ Amer.-LaFrance 1000-gal. Pumper }	1948	{ 2 1/2	1500	4550	1—35'	150
{ 1 1/2					500	700	1—14'		
Eng. 2hv	Headquarters: {Greene St., near Bellemeade St.}	5	{ Amer.-LaFrance 1000-gal. Pumper }	1948	{ 2 1/2	1500	.....	1—35'	150
{ 1 1/2					500	.....	1—14'		
Eng. 3	{Vine Street, near {Gordon Street	3-4	{ Amer.-LaFrance 750-gal. Pumper }	1924	{ 2 1/2	1150	1250	1—24'	40
{ 1 1/2	300	300	1—12'						
Eng. 4hv	{Asheboro St., near {East Bragg St.}	3-4	{ Amer.-LaFrance 750-gal. Pumper }	1948	{ 2 1/2	1500	1550	1—35'	150
{ 1 1/2	400	750	1—14'						
Eng. 5	{Walker Ave. and {Mendenhall St.}	3-4	{ Amer.-LaFrance 750-gal. Pumper }	1931	{ 2 1/2	1550	1450	1—24'	100
{ 1 1/2	200	200	1—12'						
Eng. 6	{Westover Terr., nr. {North St.}	3-4	{ Amer.-LaFrance 750-gal. Pumper }	1925	{ 2 1/2	1400	1150	1—24'	40
{ 1 1/2	200	200	1—12'						
Eng. 7	{Church Street and {Bessemer Ave.}	3-4	{ Amer.-LaFrance 750-gal. Pumper }	1924	{ 2 1/2	1100	1100	1—24'	40
{ 1 1/2	200	200	1—12'						
Eng. 8	{West Lee St., nr. {Valley Park Dr.}	4	{ Amer.-LaFrance 750-gal. Pumper }	1913	{ 2 1/2	1200	1250	1—24'	90
{ 1 1/2	250	200	1—12'						
Lad. 1hv	Headquarters	5	{ Amer.-LaFrance 85' Aerial Lad. Tk. }	1948	2 1/2	100	.....	11, total length, 246'	150
Lad. 2	Headquarters	4	{ Amer.-LaFrance Serv. Lad. Truck }	1948	{ 1 1/2	150	.....	12, total length, 269'	
Squad 1	Headquarters	1	{ Inter. Tr'k 350-gal. { Front-Mount Pump }	.....	{ 2 1/2	550	.....	1—24'	250
{ 1 1/2	800	.....	1—12'						
{ 1	350	.....	.....				
{ 3/4	50	.....	.....				

hv Company located in or near High Value District.

tator, 2 self-contained breathing apparatus, an oxyacetylene cutting torch, a 1½-inch siphon and a small amount of minor equipment; both have 2-way radios on the police department frequency installed. A 1948 Ford pick-up truck is used by the mechanic and to deliver supplies to the stations. Gasoline is stored at headquarters in a 500-gallon underground tank; companies from other stations take the apparatus to headquarters for refueling or gasoline is delivered in 5-gallon cans; similar cans are used to deliver gasoline to large fires. A good grade of fuel is used.

Hose.—See Table 5.—Hose is double jacketed cotton, rubber lined, purchased under the usual manufacturer's guarantees. It is tested to 400 pounds on delivery and to 250 pounds twice annually by connection to a pumper. Headquarters has a hose tower and Stations 3 and 6 have hose-

drying cabinets, other stations dry hose outside on walks or, during inclement weather, at headquarters. After drying, hose is rolled and stored on racks in all stations. Records are kept of tests and operations involving use of each length of hose.

Hose couplings of this and neighboring cities are of the usual screw type and of National Standard dimensions with the exception of Winston-Salem where couplings have an outside diameter of male thread of 2 59/64 inches by 7½ threads to the inch.

Appliances.—See Table 5.—Minor equipment is complete and well-distributed. Heavy and special stream appliances consist of a fixed and a portable ladder pipe on the aerial ladder truck in service, a fixed ladder pipe on the reserve aerial ladder truck, 4 portable turrets, 10 distributing nozzles, 3 cellar pipes and 2 foam generators with a good supply of foam. Emergency equipment includes 11 portable electric generators with at least one floodlight on each piece of apparatus, portable electric saws, drills, hammers and smoke ejectors, 6 portable oxyacetylene cutting torches, an iron lung, 10 resuscitators or inhalators, 10 filter type gas masks, 32 self-contained breathing apparatus and an asbestos suit. Salvage appliances, in addition to those on the salvage truck, include mops, brooms, squeegees, sprinkler head plugs, and 2 to 6 waterproof covers carried by each engine company, 8 by the service and 19 by the aerial ladder company.

Repairs.—All repairs to apparatus are made by Master Mechanic H. G. Ballinger assisted by such firemen as are necessary. Limited space is available in a cut-off section of headquarters; a traveling crane, a drill press and some hand tools are provided; only minor spare parts are kept on hand but service by the manufacturer is reported to be good. The city garage and the water works have repair facilities available when necessary.

Stations.—Six stations of ordinary and one of fireproof construction are in use; five are 1 story and two are 2 stories in height; two are new, having been built in the last 3 years, and five were built between 1905 and 1926. Headquarters has a hose tower and Stations 3 and 6 hose drying cabinets; hose drying facilities are not provided in other stations. Refueling facilities are provided at headquarters only. Station 4 is in only fair condition and response of apparatus is somewhat impeded by traffic and narrow streets. Housekeeping was observed to be good throughout the department.

OPERATION. — Discipline.—Printed rules and regulations are provided in book form but are considered by the department to be somewhat obsolete; a revised edition is expected to be issued in about a year in conjunction with the

TABLE 5.—SUMMARY OF APPARATUS.

	In Service	In Reserve
Pumpers:		
1000-gallon	2	0
750-gallon	6	1
500-gallon	0	1
Ladder Trucks:		
Aerial	1	1
Service	1	1
Squad Wagon	1	0
Rescue Wagon	0	1
Salvage Wagon	0	1
Chiefs' Automobiles	2	0
Fuel and Supply Wagon	1	0
Fire Alarm Truck	1	0
Hose, 1½-inch	6,400'	0
Hose, 2½-inch	25,450'	0
Hose, 3-inch	1,000'	0
Hose, 1 and ¾-inch for Booster	2,925'	0
Ladders, Total Length	600'	509'
Ladders, Short, on Pumpers, Etc.	19	4
Portable Extinguishers	26	8
Water Tanks	10	2
Gas Masks, Filter Type	8	2
Self-Contained Breathing Apparatus	28	4
Fresh Air Masks	0	2
Salvage Covers	56	31
Portable Turrets	2	2
Distributing Nozzles	9	1
Cellar Pipes	3	0
Siamese Connections	5	2
Ladder Pipes	2	1
Inhalators and Resuscitators	3	7
Portable Oxy-Acetylene Torches	3	3
Portable Electric Generators	9	2
Portable Electric Saws	3	2
Electric Drills	2	0
Electric Hammers	2	1
Electric Smoke Ejectors	4	0

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projected drill manual. Typewritten rules are issued by the chief as required. Minor violations are punished by reprimand by the chief or by fines, suspension or dismissal on recommendation of the chief after a hearing. Discipline was observed to be good and morale to be high.

Training and Instruction.—All training is under the direction of the drillmaster, Captain E. E. McDowell, who was appointed to his present position in 1950; he has attended the New York City fire department drill school and the Instructor's Conference at Memphis, Tennessee. The hose tower at headquarters is used as a drill tower but its use is restricted by location and lack of sufficient space. A training program is being set up involving compilation and issue of a drill manual, daily instruction in stations by the company officer and regular company training at the drill tower by the drillmaster. Exhibition drills held during this survey indicated that, although members demonstrate a willingness to learn, they are poorly trained due mainly to the short length of time the training program has been in effect. Drivers and operators are trained by the master mechanic.

Response to Alarms.—The usual response to first alarms in the principal mercantile district is 2 engine and the aerial ladder companies. In other areas the usual response is 2 engine and the service ladder companies. An additional engine and the other ladder company respond to second alarms and another engine company to third alarms. The same response is made to alarms received by telephone as to those received over the fire alarm system unless the fire is known to be of minor character. Companies respond under a municipal contract to areas adjacent to the city limits. A switch is provided at the telephone operator's desk in headquarters to turn traffic lights red in the downtown area. Traffic, especially in the principal mercantile district, causes a slight delay in response; grades are slight; over- or under-passes are provided at railroad crossings; one-way streets are prevalent in the principal mercantile district. Apparatus is allowed to respond at 10 m.p.h. more than the legal speed limit for the street it is on.

Fire Methods.—Fire department records for 1950 show that, of the 524 fires extinguished by the fire department, 101 were extinguished by brooms and shovels, 308 by booster lines, 21 by hand extinguishers, 1 by one 1½-inch hose line, 46 by one 2½-inch hose line and 47 by 2 or more 2½-inch hose lines; 36 waterproof covers were spread. Hydrant streams are generally used; pumps are connected when pressure is low or the fire is large using hard suction hose, sometimes with a 2½-inch adapter. Lines of 2½-inch hose are laid to back up booster hose lines; 1½-inch hose is mainly carried in doughnut rolls and would be wyed from 2½-inch lines for ex-

tinguishment or clean-up work. A short length of 2½-inch hose and a gate are carried attached to distributing nozzles. Shut-off nozzles with solid stream or fog tips are used on hose lines. Overhead wires, especially those of the trackless trolley transit system, would interfere with ladder-raising operations. A list of standpipe and sprinkler system data and locations is carried on each piece of apparatus. Heavy stream and special appliances provided are used when necessary to increase efficiency of operation. Salvage operations are carried out as available manpower permits; clean-up work is done after every fire.

Inspections.—Building inspections by company members have been discontinued but are expected to be reinstated as part of the training program now in process of development. The fire prevention bureau inspects business establishments but information gathered is not used for training company personnel.

Reports and Records.—Records are kept in headquarters by the department clerk of all alarms, methods of extinguishment of fires, insured and uninsured fire losses, hose, apparatus and personnel. Company journals are not kept by company officers but complete records are kept and regularly sent to headquarters to be filed. A monthly report of operations and statistics for the month and year to date is sent to the city manager by the chief.

IMPROVEMENTS.—Since the previous survey the membership in the department has increased from 47 to 101 and operation changed from single- to two-platoon; two engine and one squad companies have been added; one 750-gallon and two 1,000-gallon pumpers and an 85-foot aerial and a service ladder truck have been purchased; two new stations have been built, and hose threads have been changed to National Standard. A fire department FM radio system is to be installed including units in each station and on all apparatus in service.

CONCLUSIONS.—The fire department under the direction of a competent and progressive chief, has improved in a comparatively few years; continuation of the present good cooperation between the fire department and other city officials will materially aid in obtaining further improvements.

Methods of appointment and promotion are fairly good. Retirement and pension provisions have been provided but the lack of a compulsory retirement age could impair future efficiency of the department. There are insufficient company officers to provide one on duty at all times with each company during periods of vacation or sickness and the number of men on duty with each company is inadequate for full efficiency under modern fireground conditions. The additional

companies and stations provided have done much to improve protection to the city but ladder protection is deficient due to the long runs necessary to certain high value and high life hazard areas and another engine company is needed, principally because protection is diminished by response to areas outside the city according to contract.

Most of the apparatus in service is new or in fairly good condition but older apparatus with two-wheel brakes, difficult steering qualities or other obsolete construction factors, is not adapted to modern traffic conditions and requires constant attention with increasing difficulty in obtaining spare parts and consequent increased maintenance costs. Adequate facilities for repair and maintenance are necessary to derive maximum benefit from modern fire apparatus. The special appliances provided have done much to improve efficiency of fireground operations of the department. The installation of satisfactory hose-drying facilities at each station would result in increased life and decreased maintenance of hose. The appointment of a competent drillmaster together with the projected training manual and program including extinguishment of actual fires in a training building, will improve efficiency and eventually raise the department to a well-trained force. The continuation and expansion of the practice of sending qualified personnel to training schools and conferences for educational purposes is desirable.

FIRE ALARM SYSTEM

ORGANIZATION.—The fire alarm system is a part of the fire department under the same general supervision and under the direct supervision of Superintendent of Fire Alarm C. H. Henderson, who was appointed to his present position in 1946 after serving in the fire department for 17 years; he has 2 assistants and would get further assistance from fire department personnel if necessary. A truck is provided for their use.

Fire alarm headquarters is located on the first floor of the fireproof fire department headquarters cut off by brick walls and a single metal-clad non-automatic door. There is no protection for exposed windows. A battery room is located in the basement entered only from a small repair and storage room through a metal-clad door; the repair and storage room is entered only by a stairway from the fire alarm apparatus room and is separated by a metal trapdoor.

EQUIPMENT.—At Headquarters.—The fire alarm equipment, installed in 1926 and 1930, is of Gamewell make and automatic type. It includes a 50-circuit terminal and protector board in a metal wall cabinet, a 28-circuit protector panel, two 14-circuit operating and charging

panels and two 10-circuit repeaters with automatic rewind. A break-wheel transmitter with a wheel for each box and a punch register are located at the telephone switchboard in the watchroom at the opposite side of the apparatus floor. The only time stamp provided, on the register in the watchroom, is at present removed for repairs. No supervisory facilities are provided other than a light in the watchroom on the rectifier current supply. Low current relays are not provided. Switchboards are of slate in metal cabinets. An ADT supervisory panel with 5 circuits to industrial plants is located in the watchroom with a buzzer, indicating light and punch register with time stamp.

Operating current is supplied by individual rectifiers with a battery floating on each circuit. Rectifiers, mounted behind the operating panel including 3 in reserve, are supplied by current taken from the 110-volt station supply circuit before the lighting circuit fuses. A total of 320 storage battery cells are well-mounted in the battery room. Batteries are protected by 6- or 10-ampere fuses and rectifiers with 1-ampere fuses.

Apparatus at Fire Stations.—Each station, except headquarters, has a punch register and tapper on a box circuit and a large gong on an alarm circuit. Headquarters has a punch register and tapper in the watchroom on a local alarm circuit and 4 gongs on another alarm circuit. Each station has an automatic light switch and a telephone. A gong and a punch register are provided at the pumping station.

Boxes.—There are 241 boxes in service, all of Gamewell make, of which 78 are 3-fold, 14 are 3-fold masters, 139 Peerless, 2 Ideal masters, and 8 Peerless sector-pull type; all but the 8 Peerless non-interfering sector-pull are succession type. Thirty-seven boxes are on pedestals and the remainder are on poles; 8 boxes have key-under-glass guard doors and the remainder have quick-action doors. The 16 master boxes are auxiliary to sprinkler systems. All boxes are accessible to the public. No special indicating lights are provided at box locations. Boxes and bands on supporting poles are painted every one or two years; condition of paint observed was only fair. Works and outer cases are grounded. Twenty-three boxes were tested during this survey; all were received correctly at headquarters. Boxes are timed to operate at a speed of about 1 second between blows.

Boxes are well-distributed in the principal mercantile district and fairly well-distributed elsewhere; some important streets are without boxes for long distances and some areas are without adequate protection. It is estimated that a minimum of 100 boxes is needed.

Circuits.—Thirteen box, 4 alarm and 1 local all-metallic normally closed circuits are in use.