Manual of Water Supply Practices

M17

Fire Hydrants: Installation, Field Testing, and Maintenance

Fifth Edition

American Water Works Association

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Chapter 1

A Brief History of Fire Hydrants

This chapter is based, in part, on an article that appeared in the September 1944 *Journal AWWA* (36:9:928). The drawings in this chapter are also taken from that article.

ORIGINS

Before there were water distribution systems, water for fighting fires was available only from natural sources, such as rivers, lakes, and ponds, or from cisterns or barrels filled with water.

The first large water distribution systems were built during the seventeenth century in cities such as London and Boston. Over the course of many years, as the needs of growing populations became more sophisticated and complex, distribution systems were improved. Pipe materials improved, portable standpipes and valves were incorporated, and, eventually, the forerunners of modern fire hydrants were used.

London's first water distribution system was built sometime in the early seventeenth century. In the United States, several water systems were built before or about the time of the American Revolution. Boston's water system was built around 1652, and others were built in the latter part of the eighteenth century. The earliest water mains were made by boring out logs; the mains were then buried. When water was needed for fighting fires, a hole was dug to expose the pipe, and a hole was bored into the pipe wall. Water collected around the pipe and was conducted by buckets or through a hose directly to the fire or to a pump. After use, the hole in the pipe was plugged with a tapered piece of wood—hence the term fire plug, which has persisted to this day. The location of the pipe hole was marked so that if neccessary, the plug could be found and removed quickly.

IRON PIPE AND PERMANENT ACCESS POINTS

When cast-iron pipe replaced bored logs as water mains in the early part of the nineteenth century, it became impractical to bore random holes in pipes to gain access to water. Instead, fittings with openings, or tees, were installed at intervals along the pipe. Wooden plugs were still used to close the openings, but firefighters no longer had to dig to find them. An iron shield with a removable cover that extended from the tee to the ground's surface provided ready access to the plug. At first, portable canvas tanks or cisterns were commonly used to collect the water that spewed out when a plug was removed (Figure 1-1). Soon, however, portable standpipes came into use. After the plug was removed, one end of the standpipe was inserted into the tee; a hose connected to the other end of the standpipe carried water to the pump.

Further development of this system in England resulted in a ball hydrant, in which a ball in an iron chamber was attached to the water-main opening (Figure 1-2). Water

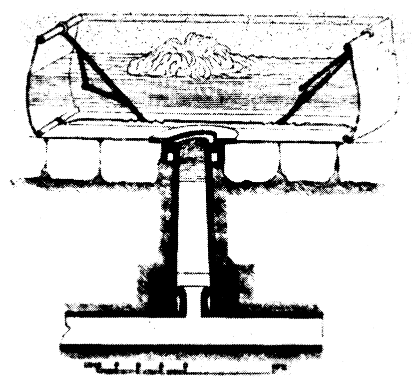

Figure 1-1 Fire-plug arrangement with canvas cistern

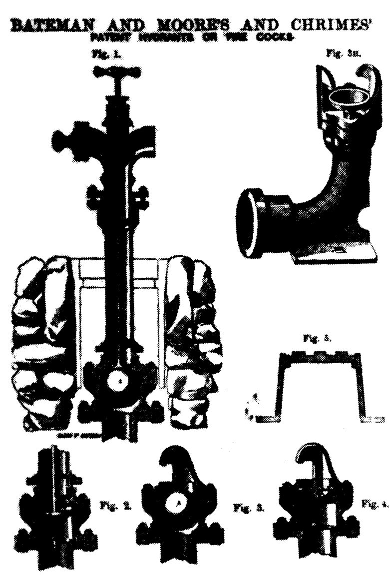

Figure 1-2 Ball hydrant, patented about 1849

pressure held the ball against a seat; after the portable standpipe had been attached, a rod could be used to force the ball down and open the valve. Later, this hydrant was modified by replacing the ball with a spring-loaded valve element, which would remain closed even if water pressure was negligible.

These hydrant designs were the forerunners of the most popular hydrant in North America today: the dry-barrel compression hydrant. With the early style, a portable standpipe was transported to the fire scene and attached to an accessible main connection below the street surface (Figure 1-3). Early dry-barrel compression hydrants were also commonly used in England and certain other countries.

Permanent connections in iron pipe led to other developments as well. One such development consisted of a valve installed belowground, usually in a horizontal branch of the water main. A rod for actuating the valve extended to just below the ground surface, where it was accessible, and an elbow could be attached to the valve outlet. In one version, the elbow terminated in a connection to which a portable standpipe could be attached; in another, it terminated in a hose connection to permit direct hookup of the hose.

DEVELOPMENT OF DRY-BARREL HYDRANTS

In North America, the use of plug-type hydrants and early modifications proved troublesome because of the freezing temperatures to which they were exposed in northern cities. To protect the hydrants from freezing temperatures, but still provide easy access, the

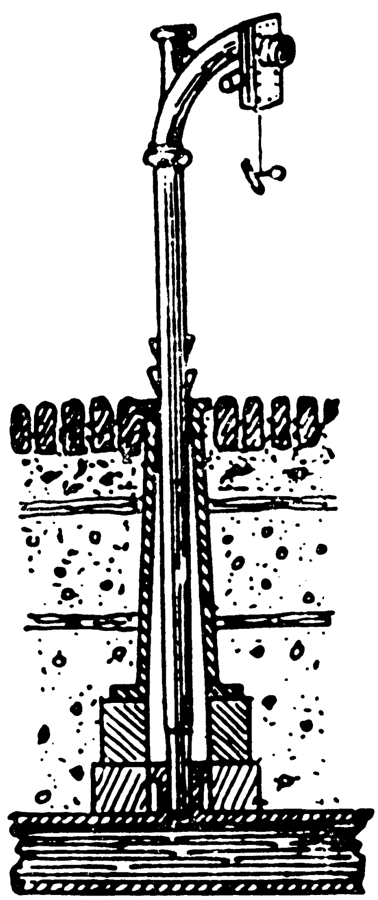

Figure 1-3 Standpipe inserted directly into main socket

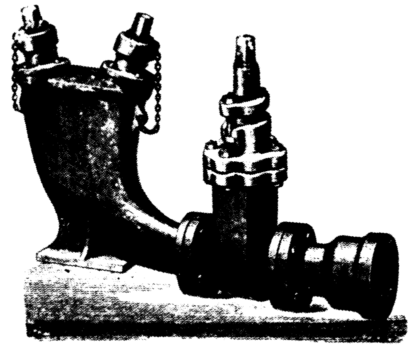

Figure 1-4 Sluice-valve-type hydrant with two outlets

mains were buried relatively deeply with a pipe extending to the ground surface. This allowed the valve to remain below the frost line but still provided an easy hose connection. To eliminate the need to empty water remaining in the standpipe after use, a drain hole was provided in the standpipe just above the valve. The drain hole was usually controlled by a valve that could be closed when the main valve was opened and vice versa (Figure 1-4).

Two types of dry-barrel hydrants were used during the mid-1800s: flush hydrants, which had the operating mechanism and hose connections in a pit with a cover plate, and post hydrants, which extended above grade. The post hydrant soon became predominant. There were two reasons for this. The obvious reason is that post hydrants were easier to find and to use, particularly in wintry, snowy climates. However, another reason may well have been more persuasive. Early on, professional and volunteer firefighting brigades competed against each other. (Initially, insurance companies paid professional firefighters to protect insured properties.) When a fire alarm sounded, one fireman from each group would race ahead of his company to secure a hydrant for his brigade to the exclusion of its rivals—and it was easier to sit on a post hydrant than to sprawl over the pit of a flush hydrant.

RECENT DEVELOPMENTS

When buckets or hand pumps were used to carry water from a hydrant to a fire, hydrants did not need to be served by high pressure nor did they require very large valve openings. The volume of water available to fight a fire was limited by the capacity of the conveyance rather than the size of the valve opening. Because buckets and hand pumps could carry only limited amounts of water, hydrants with relatively small valve openings were usually more than adequate.

When steam-driven pumps became available, the flows from older hydrants with small valve openings often proved inadequate, so hydrants with larger valve openings came into use. Initially, a 4-in.-(10.2-cm)-diameter valve opening was considered adequate, but eventually 5-in. (12.7-cm) and 6-in. (15.3-cm) sizes were developed. Today, the vast majority of hydrants are connected to the main by 6-in. (15.3-cm) pipe. Most main valves are 4½ in. (11.4 cm) to 5¼ in. (13.3 cm) in diameter. Hydrants may include one or two outlets for connecting large-diameter hoses plus one or two outlets for a 2½-in. (6.4-cm) or 3-in. (7.6-cm) hose.

Dry-barrel hydrants currently produced are post hydrants and are usually furnished with drain valves that are automatically operated by the main valve mechanism. The lower barrels of these hydrants are in direct contact with the ground. The most popular style of the dry-barrel hydrant is the traffic model, which has both a breakable barrel and operating rod parts located at the ground line. These components are designed to break on impact, thereby protecting the remainder of the hydrant from damage. The design permits quick and inexpensive repairs should the hydrant be struck by a vehicle. Also, after impact, the hydrant is designed to automatically close, thereby preventing any leakage to pass the main valve seat. Because of their popularity, traffic-model hydrants have become the unofficial industry standard. Dry-barrel flush hydrants are generally used only in areas of vehicular traffic, such as parking lots and roadways and airport runways and taxiways.

Where freezing temperatures are rare and never persistent, particularly in the coastal areas of California and Hawaii, wet-barrel hydrants are often used. The wet-barrel hydrant is designed so that the entire interior of the hydrant is pressurized at all times. It is equipped with one or more valved outlets above the ground to which hoses can be connected. Some designs have auxiliary check valves that close if the hydrant is broken, thus preventing local flooding.

Several designs of tamperproof hydrants have been developed in recent years. These have built-in or attached devices that discourage unauthorized use of the hydrant by requiring the use of special equipment for the removal of outlet caps or for operation of the valve-opening mechanism.

Use of nonthreaded-type (also known as Storz) connections on the fire hydrant pumper outlets, which allow the fire department to connect large-diameter supply hose (LDH) directly to the fire hydrant, is being adopted by an increasing number of hydrant users to replace the use of threaded-type pumper outlet connections. The nonthreaded connections used in the United States, either 4 or 5 in. nominal size, are fully engaged with a quarter-turn of one end, and, unlike their threaded counterparts, are “sexless” in that any two ends of the same size can be joined.