MUELLER®

Record

SPRING 1978

Charleston's "underground"... a boon to water industry

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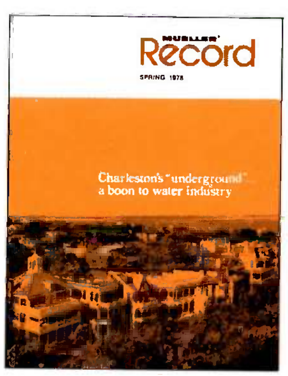
SPRING 1978

Published by
Mueller Co.
500 West Eldorado St.
Decatur, Illinois 62525

Jim Cussins
Editorial Consultant



About the cover

Charleston, South Carolina provides a historic setting for a new underground water tunnel.

Charleston's "underground", delight to tunnel digger and water works alike

There is an "underground" in Charleston, South Carolina. Not a group of latter day radicals, but one that's been there for millions of years . . . just waiting to benefit this colorful, historic Southern city.

That "underground" is a geological rarity called Cooper marl. Soft enough that tunnels can be cut through it easily. Dense enough that those tunnels can be used to transport water. And that's what the City of Charleston has been doing since 1928. Using such tunnels . . . Now it is completing another.

"The geological formation of this region is a rarity . . . an engineer's delight and a boon to water departments," wrote reporter Gardner Miller in the *Carolina News* last year. Cooper marl is fossilized limestone, ideal for tunneling. Tunnels through Cooper marl rarely need supports since, once exposed to air, the stone sets almost like concrete and is impervious to water. That is why a hole through it makes a good water pipe.

New tunnel will satisfy an industry's thirst

The new tunnel, started in 1976, was scheduled for completion by the end of 1977. It is eight feet, five inches in diameter. And extends two and a half miles from the Charleston waterwork's Back River reservoir, under the Cooper River, to the Amoco Chemicals Corp. plant, north of Charleston. Amoco needs more water and the new tunnel will provide it.

The project is a joint undertaking by the City of Charleston Waterworks Department and Commissioners of Public Works, as well as Amoco. Although it is considered a facility of the Charleston Water Plant, the tunnel is being paid for by Amoco.

The Amoco complex will draw upwards of 15 million gallons of water a day through the tunnel from the Back River reservoir, according to Mr. John R. Bettis, Commissioners of Public Works manager. But, according to Bettis, Amoco's withdrawals won't affect the water needed by its other users.

Charleston has many tunnels

Two other tunnels help supply the city and local industry with water. The first, built in 1928, was four and a half miles long. It was extended in 1937 to deliver 25 million gallons of water per day to the West Virginia Pulp and Paper Co. near Charleston.

In 1955, a second tunnel was dug to carry 75 million gallons of water per day from Goose Creek Reservoir to the city. Other tunnels are used by the sanitary district to carry sewage under Charleston harbor to a treatment plant on Plum Island.

Marl cuts costs, speeds operations

Construction began late in 1976. First, a 19-foot diameter access shaft was drilled down 55 feet under the Back River reservoir. A tunneling machine

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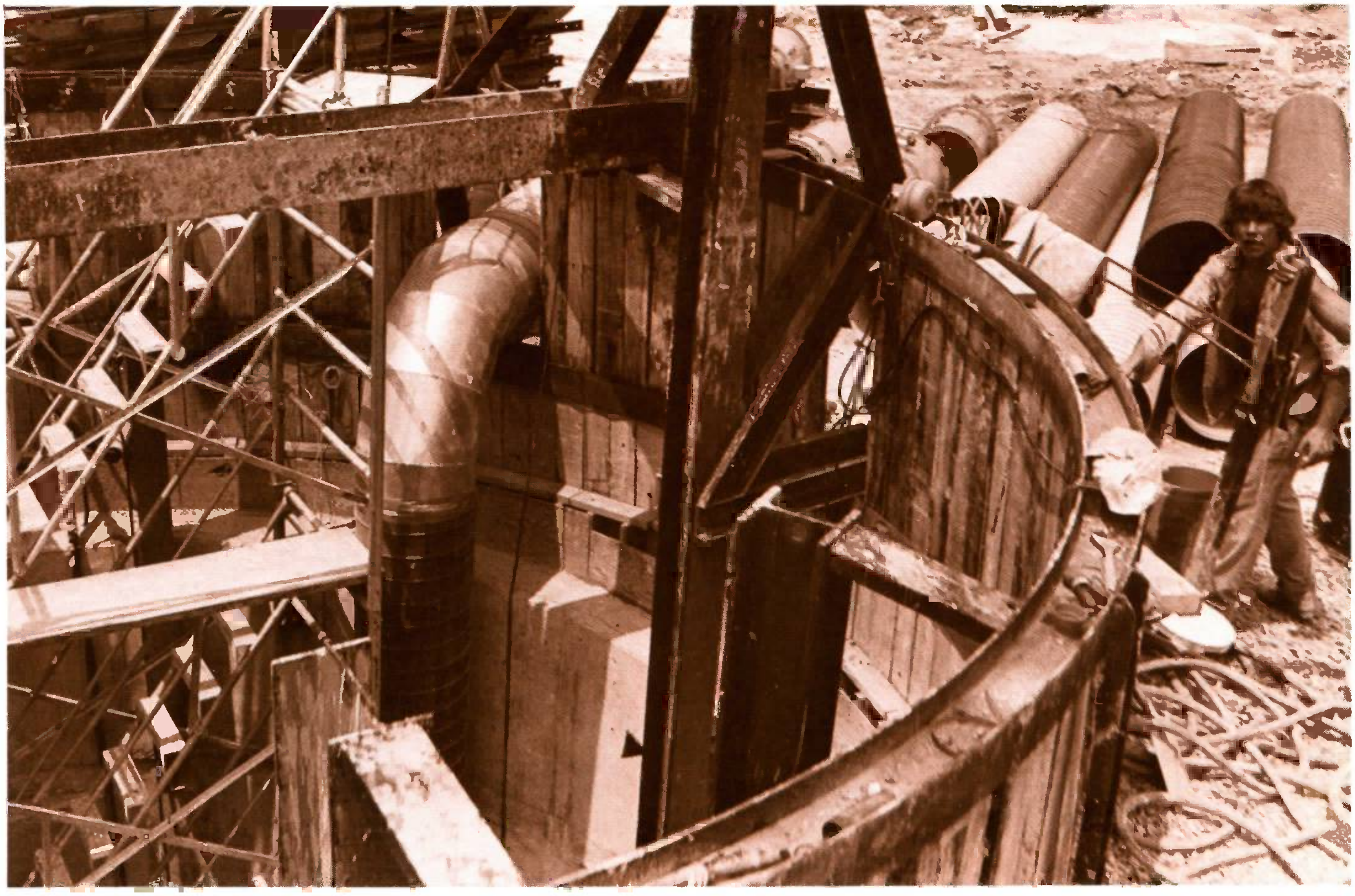


One of the 19-foot diameter access shafts which lead to the tunnel. The reinforced concrete liner is to keep out surface water. Pipe for the tunnel ventilation system extends into the shaft.

Behind Mueller Sales Representative Bob Maxwell, the Cooper River flows near Charleston, South Carolina. Amoco Chemical Corp's. new water tunnel lies 55 feet below the river channel.

Charleston "underground" continued

then bored through the marl in a gradual upward slope under the Cooper River, and then to another access shaft near the Amoco site.

The tunnel itself will require no lining or supports because of the Cooper marl's characteristics. This cut costs and speeded up construction considerably. The access shafts, however, are lined with reinforced concrete near the ground's surface to seal against groundwater.

Tunnel boring similar to mining

Digging a tunnel and digging a mineshaft are similar in many ways, including the equipment and techniques used, according to Jerry Parnes, one of the consulting engineers.

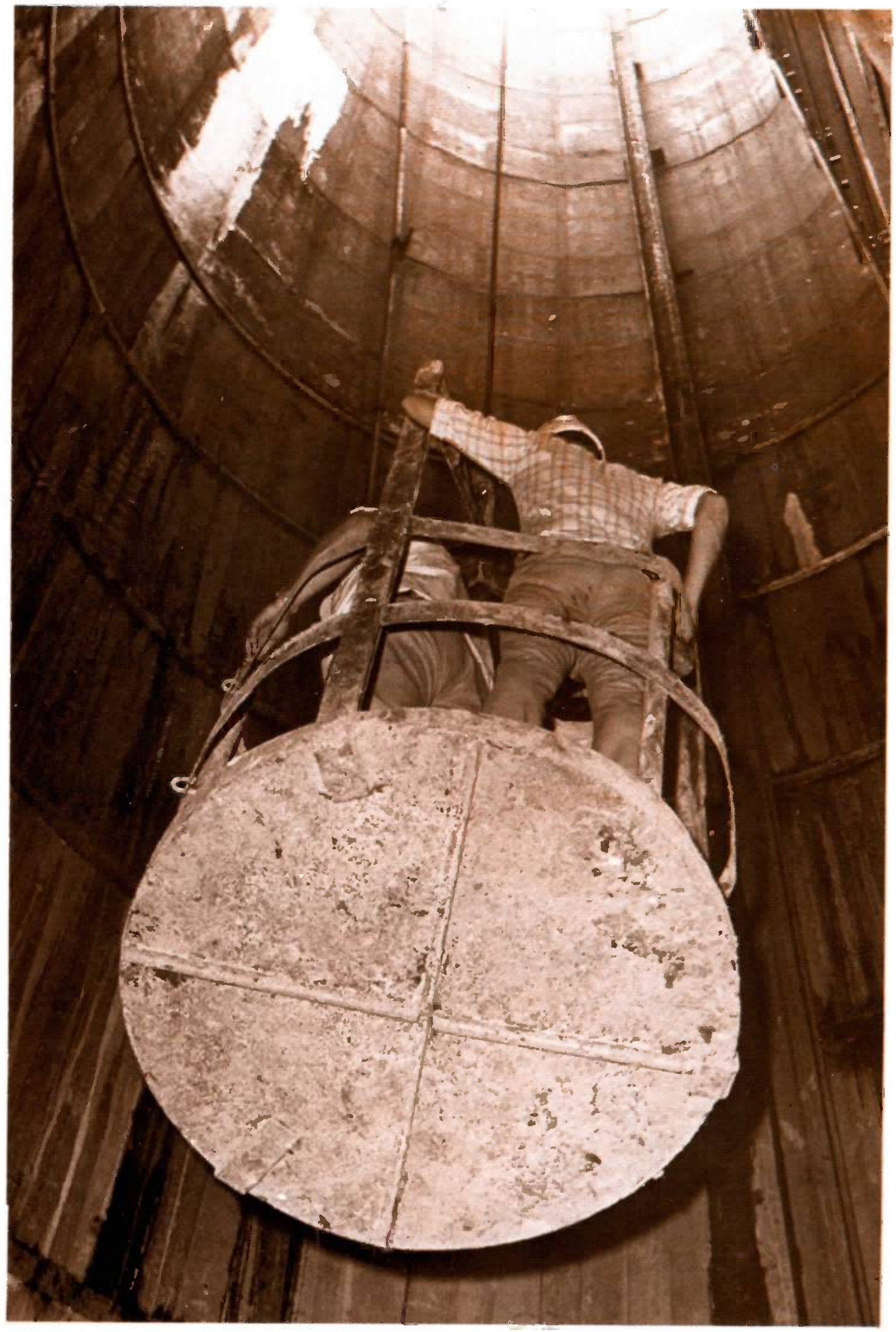
A mine train, for example, removes the excavated marl and carries workers and equipment to and from the tunnel head. About 35,000 cubic yards of marl has been removed from the tunnel. That's enough to bury a football field under about 20 feet of the material.

Although the tunnel is being constructed for Amoco's use, Bettis said, other users may patch into it in the future. And it may one day support a water treatment plant on the east side of the upper Cooper River, if Charleston's population ever expands that far north, he added.

Mueller fire hydrants, a common sight in Charleston

While Mueller products aren't used in the tunnel system, they are well known to Charleston city fathers. Some 95% of the hydrants installed over the past ten years in Charleston are Mueller fire hydrants, Bob Maxwell, Mueller Co. Southeastern Sales Representative, reports. A number of Mueller gate valves are also used in the city's water system.

Material for this story was provided by Bob Maxwell, Mueller Co. Southeastern Sales Representative, Columbia, South Carolina.



Having to go down the access shaft to the tunnel below, involves a ride in a cage lift suspended at the end of a cable.

Standing in the marl tunnel far below the bottom of the Cooper River are Bob Maxwell, Mueller Representative, John R. Bettis, Commissioners of Public Works manager, and Steve Kinard, assistant manager.

Standing by one of the numerous Mueller fire hydrants on the Battery in Charleston are, left to right, Steve Kinard, Bob Maxwell and John R. Bettis.

Three centuries of history live in Charleston.

"Charleston is unlike any American city. Founded as an English colonial capitol, it developed in the image of London, with the variety of Europe, by the hands of Africa and to the air of the Caribbean." This statement taken from a tour folder provides a clue to the colorful character of South Carolina's largest and most historically important city.

The first English settlement in South Carolina was made at Albermarle Point on the Ashley River in 1670. Then, in 1672, "Charles Town" named in honor of King Charles II, was settled, on the present site of Charleston. The seat of government was moved there in 1680.

Shortly after it was chartered, Charleston became one of the largest and wealthiest settlements south of Philadelphia; the brilliant social and cultural center of the colonies, and later of the newly-independent United States.

The old city with its narrow, winding streets has accumulated three centuries of magnificent architecture. Today, hundreds of mansions, churches and other historic buildings stand as monuments to every period of prosperity and to the dynasties that ruled the city and helped found the nation. Surrounding Charleston are plantations, gardens and other scenic attractions dating back to the 1600s.

Two centuries of violence and tragedy

Charleston's history is not entirely one of peaceful plantations and lovely gardens slumbering in the southern sunshine. The city was attacked by a combined Spanish and French fleet in 1706; withstood attacks from the British in 1776 and 1779; but in 1780 was captured from the land side by a British army led by Sir Henry Clinton. It became the base of the Crown's operations in the Carolinas, remaining under military rule until 1782.

In April, 1861, the bombardment and capture of Fort Sumter (now a National Monument) in Charleston Harbor, by the South Carolinians, marked the beginning of the Civil War. And from 1862 to 1865, Charleston was almost continually under siege by Federal naval and military forces.

In February 1865, the Southerners evacuated the city after burning large stores of cotton and other supplies to keep them away from the Union Army.

Charleston also suffered other disasters in its history. It was devastated by hurricanes in 1699, in 1753, and in 1854; by epidemic in 1699 and 1854; by fire in 1740. An earthquake in August 1886 damaged 90% of the city's buildings.

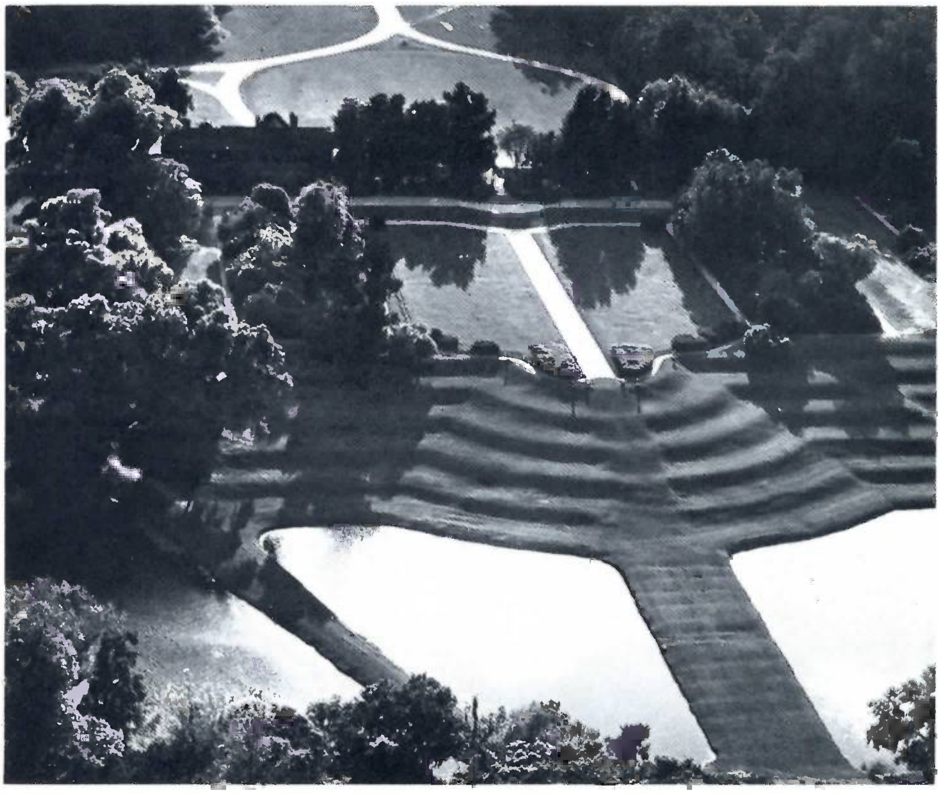
During World War I, Charleston's importance as a port for foreign coastal and inter-coastal commerce grew rapidly. Today, merchant ships from all over the world dock regularly at the downtown waterfront piers.

Many "nation's oldest" are here

Besides the oldest landscaped gardens at Middleton Place, (see photo), Charleston is the home of many other members of the "nation's oldest" category.

Some of our nation's oldest churches stand in Charleston, including the famous St. Michael's Episcopal Church. The chiming bells of St. Michael's still mark the time in quarter hours and

Used as the fictional "Tara" in filming of "Gone With the Wind," Boone Hall Plantation dates back to 1681. Its famous Avenue of Oaks, original slave quarters and stately portico have made it America's most photographed plantation.



Laid out in 1741, Middleton Place in Charleston is the home of the oldest landscaped garden in the U.S. With its terraces, walks and butterfly lakes, this garden was said to have "out-Englished" the gardens of England and was the talk of London's snobbish garden circles in 1753.

ring out a welcome for worship on Sunday mornings as they did in 1791 when George Washington worshipped there while on a tour of the South.

The Old Exchange is the nation's oldest customs house wherein the world's first semi-submersible military attack boat was designed in 1863. It also was the site for the Charleston Tea Party which, like the Boston Tea Party, took place before the American Revolution.

Also pre-Revolution is the nation's oldest museum — the Charleston Museum. It contains heirloom antiques and other memorabilia capturing the spirit of Charleston's history and the country's growth.

Another old museum, the Confederate Museum, contains relics of the Civil War including uniforms, swords, documents and the first Confederate flag to be flown over Charleston. The first rifled cannon made in the Confederate States can also be seen there.

A full sized reproduction of the Confederate State Submarine Hunley, the first submarine to sink a warship, is on display in the Hunley Museum.

The old Dock Street Theatre (see photo), where the first plays produced in America were presented, opened in 1732. The theatre is still in use today by Charleston's own Footlight Players.

Oak Grove Children's Home, founded in 1790, is our nation's oldest public child-care facility. It was designed to "care for all such poor orphan children and children of poor distressed or disabled parents" and still does so today.

Modern additions to Charleston history

Some modern technological achievements are on display in this history-laden city, too. Charleston is a base for the country's prime war weapon, the Polaris nuclear powered submarines, which cruise down Cooper River and through Charleston Harbor to underwater stations all over the world.

Charleston is also the home of the aircraft carrier "Yorktown," known as WWII's "Fighting Lady." She is on display at the Naval and Maritime Museum.

In spite of three centuries of history, all the tragedies and a modern era of commercial and industrial growth, this city has never lost touch with its past. Charleston will always be a rich, colorful collection of Americana.

This group of houses on historic Church Street in Charleston show the popular Charlestonian "single house theme." They date back to 1759 to 1807. In those days, these fine residences housed an office in the front downstairs room for the gentleman of the house.

The Dock Street Theatre, site where the first U.S. plays were produced, features a handsome facade with a cast-iron balcony in a morning glory pattern and sandstone columns with rare carved mahogany capitals and cornices.

FOR THE EXTRA MARGIN OF PERFORMANCE

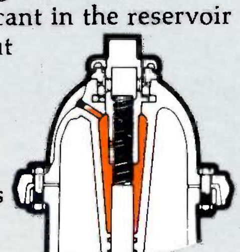
EFFICIENT DESIGN FOR MAXIMUM FLOW...THE MUELLER® CENTURION® FIRE HYDRANT

The real test of a fire hydrant is in its flow characteristics—under actual operating conditions. That's where the Mueller Centurion Fire Hydrant performs best.

The Centurion Fire Hydrant is designed with smooth transitions and long radius internal contours to keep turbulence to a minimum even at high flow rates. It's well within AWWA Standards for pressure loss characteristics. The patented Mueller design (Patent No. 3980096) really pays off under actual operating conditions with minimum pressure loss and excellent flow . . . right out to your pumper and hose nozzles.

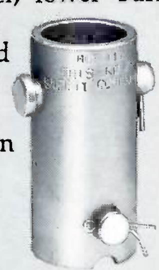
Built-in performance—bonnet to shoe

The dry-top design with self lubricating system assures easy operation even after years of service. All stem threads and bearing surfaces in the operating mechanism are lubricated each time the hydrant is operated. A thermoplastic anti-friction washer further assures easy operation throughout the life of the hydrant. O-ring seals are used to retain the lubricant in the reservoir while sealing out water and contaminants—stuffing box bolts and packing adjustments are eliminated.

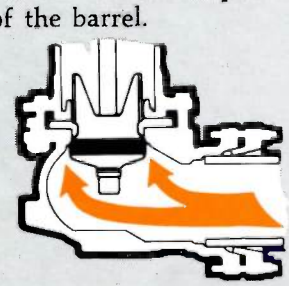


Hose and pumper nozzles are threaded in for easy replacement if damaged or for changeover to different thread style. A special locking method makes insertion simple. And the nozzles can be faced in any direction simply by loosening the safety flange bolts and rotating the upper barrel assembly.

The safety stem coupling and safety flange design help minimize traffic damage to the hydrant. The safety flange on the barrel breaks cleanly and the safety stem coupling pulls apart to prevent or reduce damage to the upper barrel, lower barrel and stem. The main valve remains closed and service is easily restored by simply replacing the broken parts with the low cost repair kit.



The compression type main valve closes with pressure for positive seal. Its conical shape assures smooth flow and low pressure loss. Double drain valves are force flushed each time the hydrant is operated and assure complete drainage of the barrel.



The patented shoe has been carefully designed with smooth transitional contours to assure maximum flow with minimum head loss. The specially contoured shoe also has large blocking pads for easing setting and two lugs for strapping. (Strapping lugs are not provided on flanged connections.)

A unique bolting arrangement lets you remove the lower barrel should repairs be needed, or remove the shoe to change end connections—without disturbing the main valve or seat ring assembly.

Good fire protection starts at the hydrant. Put the dependable Mueller Centurion Fire Hydrant to the test. It meets AWWA Standard C-502 and is well below the limits for pressure loss at all flow rates. Available in a choice of sizes and inlet connections. For complete details, contact your Mueller Distributor or Mueller Sales Representative, or write direct.

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serving the water and gas industries since 1857

Ancient civilizations had "modern" water systems

Ever since man first cupped his hand to drink and caught a glimpse of his own reflection in a pool, water has fascinated and inspired him, and played a vital role in the development of civilization.

With the development of civilization came technology. But as advanced as the modern water industry is, it could not be so without the remarkable contributions of earlier civilizations.

Romans spread technology throughout ancient world

The Romans (500 B.C. to 500 A.D.) were master water engineers who carefully studied the cycles of evaporation, rainfall and runoff. They made many valuable contributions to the growth of water supply systems.

Perhaps the greatest Roman contribution was the aqueduct, the most common mode of water transportation in the ancient world. They carried water from nearby mountain springs or lakes into cities. Some of these graceful structures which supplied a continuous, gravitational flow of water, are still in use today.

The first Roman aqueduct, and the first of the famous nine leading into Rome was Aqua Agrippa. It was built in 300 B.C. by slave labor and financed by the state. Other aqueducts were financed by wealthy benefactors and profit from battle spoils.

Where the Romans went, they conquered. Where they conquered, they spread their water technology, building over 200 city water supplies throughout the ancient world.

Of these 200 Roman water systems, ruins can be seen in Rome, throughout Italy, Africa, Spain, Portugal, Great Britain, France, Germany and Asia Minor, according to *A History of Technology*.

The Romans, master engineers, built aqueducts (this is the exit point) to carry water from nearby mountain lakes into Rome. (All photos supplied by Edwin A. Scott, Jr.)

One of the best preserved of these Roman aqueducts is Pont du Gard built in 20 B.C. in France. It is a massive tier of three levels of arches standing 150 feet high. Covering 24 miles, it carried water from the Uzes River to Nines, France.

Great bathers

Besides great engineers, the Romans — lovers of luxury — were also great bathers. So with the aqueducts throughout the ancient world, went the baths.

Viewed as a social activity, bathing went on in plush private baths or large public baths. They all had the convenience of hot, warm and cold water. Statues, gardens, ornate fountains, marble floors, and swimming pools decorated these structures. They were marvels of art as well as of plumbing. When the Romans conquered what is now the city of Bath, England, they found a bather's paradise with hot underground waters. There, they built a resort called Water of Sulius.

This enormous complex had sluiceways to carry water from the warm springs to the bathhouses. One great bath was larger in size than an Olympic size swimming pool. This huge vessel was lined with lead to retain water heat and to make it watertight.

To keep the baths from becoming stagnant, water was circulated in them constantly by a network of pipes. To make the pipe, the Romans rolled sheet lead on a cylindrical tool, made a single lap seam and hammered it flat.

By the Fourth Century A.D., Rome, the capital of the Empire, had 11 public baths, 856 private baths, 1,352 fountains and cisterns all supplied by over 300 miles of underground aqueducts. It is estimated that the city

Continued on page 14

Visitors to Bath, England, may examine lead pipe fabricated by Romans to carry hot ground water from nearby springs to bathing areas.

Where the Romans conquered, they took their knowledge with them. This masonry sluice conducted water into the pools at Bath, England.

Ancient water systems continued

used 38,000,000 gallons of water per day.

To make all of these water structures durable and watertight, the Romans invented a concrete that would set underwater. It was a mixture of fine chocolate-red volcanic earth with lime.

Assyrians — greatest ancient world hydraulic engineers

But advanced water technology didn't actually begin with the Romans. Among the earliest in recorded history to bring water use to a high state were the Assyrians.

The Assyrians were an ancient people who lived on both shores of the Tigris River in Asia Minor (modern-day Iraq), during 2000 to 612 B.C. Their contributions to hydraulics — the science of water and its motion — are outstanding.

"Assyrian skill in hydraulics has seldom been equaled in modern times," according to Donald E. Carr, author of a history about water systems called *Death of the Sweet Waters.*

One of their most remarkable accomplishments is the Aqueduct of Jerwan, built in 691 B.C. for irrigation and domestic use. It is one of the first notable examples of a public water system, according to James Finch, author of *The Story of Engineering.*

This aqueduct, stretched 30 miles from the Greater Zab River to Ninevah, was as wide as a road, was paved with masonry and had a partial roof for protection.

"The most astounding feature . . . is the fact that the project was completed in 15 months, which is, perhaps, better than could be expected of our Army Corps of Engineers," notes Mr. Carr.

The Assyrians also used water technology to support their military activities. When Assyrian armies were out on long military expeditions, they drilled "speedy" wells for water. To do this, they heated solid rock, then poured cold water on it causing it to split. They removed the rock and repeated the process until they found underground water.

The Assyrian army dug 470 water holes in 885 B.C., according to *A History of Technology.*

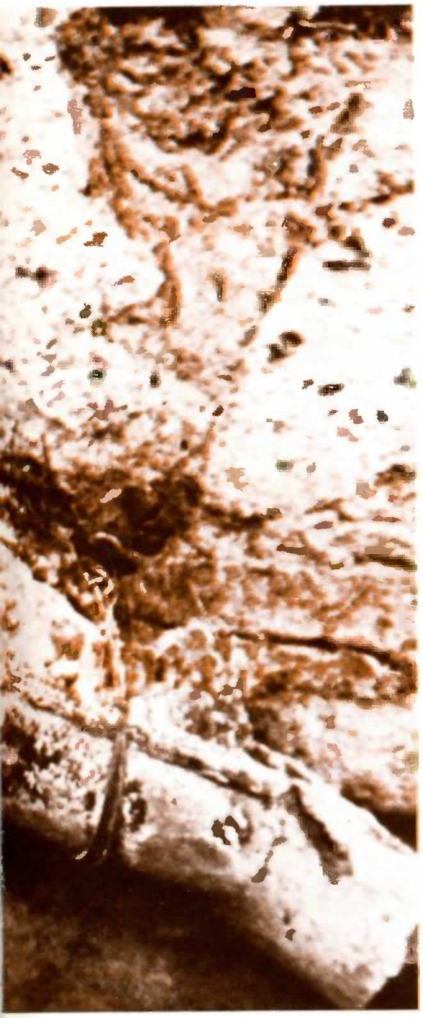
Assyrians used water as a weapon, too. During combat, troops would divert a river overnight to flood an enemy village.

Another "modern" water system 20 centuries B.C.

On the island of Crete in the Mediterranean Sea, on the site of the ancient city of Knossos, stands the Palace of Minos, the largest and best preserved of Crete's ancient buildings. Built around 2000 B.C., it had a water system that was quite modern even for today, reports Edwin A. Scott, Jr., president of Scott Periodicals Corporation. Mr. Scott had an opportunity to see ruins of many ancient water systems during his travels. (He also took the photographs accompanying this article.)

The uniqueness of this system lies in its separate flumeways for sanitary drainage and for storm drainage. Even today, many communities use the same conduits to carry off storm drainage and house wastes.

Mr. Scott notes, "Water, of course, has always been the common denominator of life and always will be. But . . . we sometimes forget that the water industry's heritage is a rich one. Our foundations, indeed, extend back to the earliest days of civilization."



Roman lead pipe, which can still be used, conducted water under pressure from the street main in Pompeii to individual homes.

A large cistern, outside the Palace of Minos on Knossos in Crete, dates from about 2100 B.C.

Why should fire hydrants be inspected?

(Anywhere, U.S.A.)
Firemen rushed to the scene of Any Company, Anywhere, U.S.A., to battle a three-alarm blaze that broke out Anytime yesterday. The frustrated firemen were unable to contain the flames in time to save the building.

Cause of the blaze is unknown, but the reason the flames were uncontrollable is known — an improperly maintained fire hydrant that would not operate.

Important fire fighting time was lost as firemen looked for an operable fire hydrant.

Someone didn't realize the importance of fire hydrant inspection to this community's fire protection system. If that fire hydrant had been inspected properly, twice a year, as recommended, it would have been in good operating condition. Any company, anywhere, anytime would have a better chance of being saved.

The importance of fire hydrant inspection is the topic of an article written by Dick Seevers, Mueller Co. representative in Colorado. His article was written for the American Water Works Association (AWWA) monthly publication, OPflow. Here are excerpts of his article.

Fire hydrant inspection

In most cases, the water utility is responsible for buying, installing, maintaining and repairing fire hydrants. The fire hydrant is a vital piece of the community's fire protection system and should be inspected at least twice a year to assure that it's always ready for immediate use.

In view of this, it would not seem unreasonable, particularly in smaller communities, to call on your fire department for some manpower assistance with these inspections. This will also be an educational opportunity for those firemen who are unfamiliar with the construction and operation of this piece of fire fighting equipment.

The personnel who conduct your fire hydrant inspections should be thoroughly familiar with the design and operation of the various types of fire hydrants they will encounter. Don't hesitate to contact your supplier for instruction manuals, literature and assistance.

Types of fire hydrants

Dry barrel fire hydrants are generally of three types. One is commonly called the "compression type." It closes with the pressure and opens against the pressure. The operating threads are located at the top, usually protected from the waterway by a packing of some type, and may be lubricated either manually or automatically.

Very similar to this type is a hydrant that opens with the pressure and also has operating threads at the top.

Another type of dry barrel fire hydrant, the "Cory type," opens with the pressure and closes against the pressure. The operating threads are located at the bottom of the stem, opening and closing the main valve with a toggle joint arrangement.

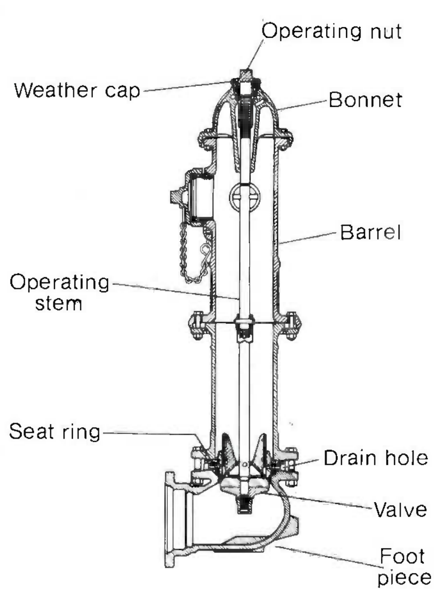
A third type of dry barrel fire hydrant is the "gate type." It too, is operated by threads at the bottom of the stem and operates much like a gate valve.

In addition to these dry barrel fire hydrants, there is the "wet barrel" type. It's used in warm climates and has independent gate control of each outlet.

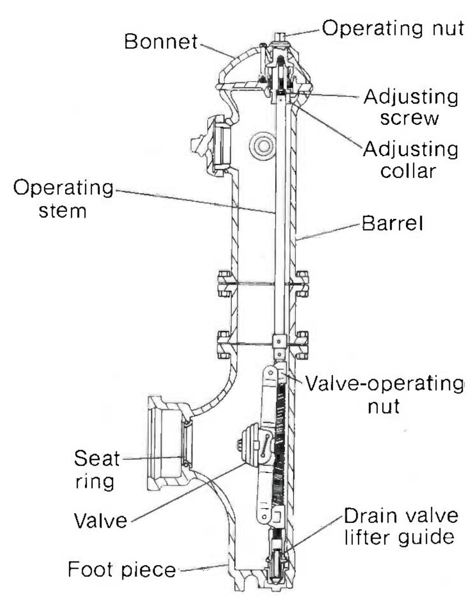
Drains

All dry barrel fire hydrants have one thing in common — progressive drains. This means they do not open or close instantly, but operate progressively as the fire hydrant opens or closes.

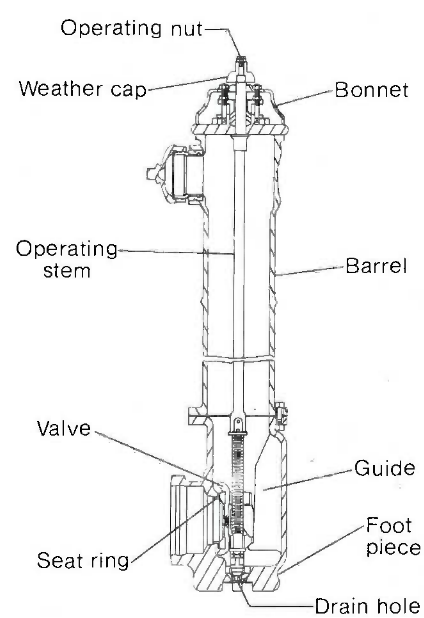
In general, it takes from three to five turns to completely close the drain. All of the people who may operate fire hydrants should be aware of this fact.



Compression



Cory



Gate

A partially open drain, under full pressure, can soon saturate the drain field. This softens the support behind the "kick block" and could result in the fire hydrant blowing off of the lateral. In the better hydrant designs, the drains and floorway are connected. They flow together with drains under line pressure for only a portion of the first full turn in opening or the last full turn in closing. Drain then functions to clear the hydrant of water by gravity after the main valve is fully closed.

Inspection procedure

1) Remove outlet nozzle caps and check for water in the barrel. Water indicates either a leak in the main valve or high groundwater.

2) Check for main valve leakage with an aquaphone on dry barrel fire hydrants. It's possible to have a slight leak that's being handled by the drain field. For wet barrel fire hydrants, use visual means to spot seat leakage at each valve.

3) For a compression type fire hydrant, determine if it's manually or automatically lubricated. A screw or fitting in the operating nut indicates manual lubrication. Check lubricant level and lubricate if necessary. A fill plug in the bonnet suggests a reservoir where automatic lubrication occurs. Check reservoir supply.

4) Replace nozzle cap and open hydrant all the way. In this balanced pressure situation, the hydrant should operate easily. Wet barrel hydrants require that each valve be so operated using a special test outlet nozzle cap. If stem action is tight, exercise it by opening and closing it several times until the action is free and smooth.

5) With nozzle caps on, the main valve fully open and full pressure applied, check the various outer connections, nozzle connections, caps and seals for leakage.

6) If leakage is detected, tighten or recaulk outlet nozzles. Lubricate and tighten compression packing. Or replace O-rings (or similar seals) and gaskets. If leakage cannot be corrected with the tools on hand, record the nature of the leakage for prompt attention by those responsible for repairs.

7) On dry barrel hydrants, close the main valve to the position at which the drains open. "Power flush", allowing the water to flow through the drains under pressure for ten seconds. Fully close and remove nozzle cap. Observe the drain rate.

8) Flush the fire hydrant. This is best done through the pumper nozzle — the bigger the opening, the greater the flow and the more effective the flushing action. Use a hose or diverter. You'll often receive two "slugs" of dirty water. The first out of the hydrant lead and the second out of the main.

9) Close the hydrant. Always be sure the last few turns are done slowly to minimize the possibility of water hammer. Observe the drain rate. If it's draining properly, you should feel a suction if you place your palm over an outlet. Don't tighten the last nozzle cap too soon or the inability to draw in air will retard or stop drainage.

10) Check again for seat leakage by aquaphone for dry barrels and by sight for wet barrels.

11) If your dry barrel fire hydrants have permanently plugged drains because of high groundwater in your area, then pump out residual water from the barrel.

12) Remove nozzle caps and inspect for thread damage or cross threading. Wire-brush the nozzle and cap threads. Clean and lubricate the outlet nozzle threads. A dry graphite base lubricant works well. Check for ease of operation. Check to see that nozzle cap gaskets are in good condition, too.

13) Check for free action in cap chains. If chains bind, open the loop around the cap until action is free. This prevents kinking during emergencies.

14) Replace nozzle caps. Tighten with spanner wrench, then back off slightly so caps aren't too tight.

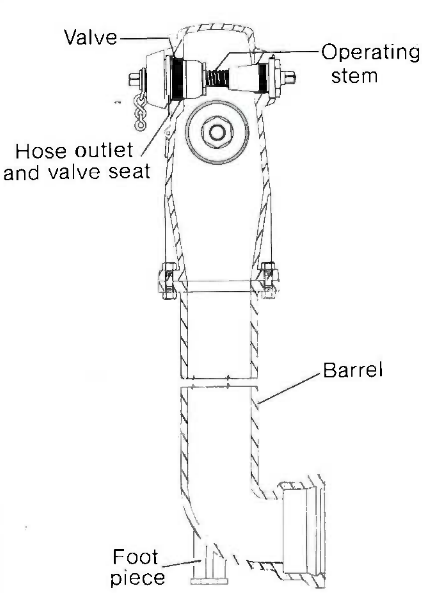
15) Lubricate operating nut threads. Check manufacturer's instructions on this.

16) Be sure the gate valve ahead of the hydrant is fully opened.

17) Clean the exterior of the fire hydrant. Now is a good time for repainting if needed.

18) Tag all inoperable fire hydrants. Report them to your fire department and request scheduled repairs or replacements to prevent time loss in emergencies.

19) Keep a record of your inspection and any repair work performed. Most manufacturers have cards available for this purpose.



Wet-barrel

Other things to consider

Fire hydrants should be set to the proper grade. But grade may change. When this happens, the hydrant should be adjusted accordingly.

All manufacturers offer extensions and lower sections in varying lengths. All hydrants seriously above or below grade should be scheduled for correction. Fire hydrants at the proper grade are better fire fighting tools because they're easier to use and maintain.

A basic stock of repair parts should be maintained and available for immediate use. This reserve of parts should include main valves, since they seem to be the most frequently replaced part on a fire hydrant. Other important items are drain components, seat rings, oil for refilling reservoirs, stem seals or packing, and "traffic damage" repair kits.

These parts should be stocked for the various types and sizes of hydrants in your system. The quantity of parts you will need can best be determined by your experience.

A good reference for routine inspection and maintenance procedure is contained in the AWWA manual M-17, "Fire Hydrants — Installation, Operation and Maintenance."

MUELLER NEWS

Warren Crawford to leave Mueller Co.

Warren D. Crawford has resigned as Vice President and General Sales Manager of Mueller Co. after completing 26 years with the company. He has joined a large Mueller distributor headquartered in Houston, Texas.

Warren, who is highly regarded by friends and associates at Mueller Co., will continue to act as the official Mueller Co. delegate to the Water and Waste Water Equipment Manufacturers Association. He also serves as a director of that organization.

Warren joined Mueller Co. as a sales representative in 1952. He was promoted to District Manager of the Western District based in Los Angeles in 1957. In 1973, he became General Sales Manager of Mueller Co. and was elected a Vice President in 1976. Warren and his wife, Helen, will make their new home in Houston.

Robert J. Ott named General Sales Manager

Robert J. Ott has been promoted to the position of General Sales Manager of Mueller Co., succeeding Warren D. Crawford. Bob will be responsible for the sales activities of all the field sales personnel in the United States.

A native of Decatur, Bob majored in economics at Notre Dame where he also attended graduate school. He joined Mueller Co. in 1955 as a sales representative, and completed an extensive training program dealing with both the water and gas industries. Bob was promoted to the position of District Manager of the Southern District in 1960. He served in that capacity until recently when he was named General Sales Manager.

Formerly based in Atlanta, Georgia, Bob, his wife, and daughter will make their new home in Warrensburg. The Otts also have a son who lives in Atlanta, Georgia.

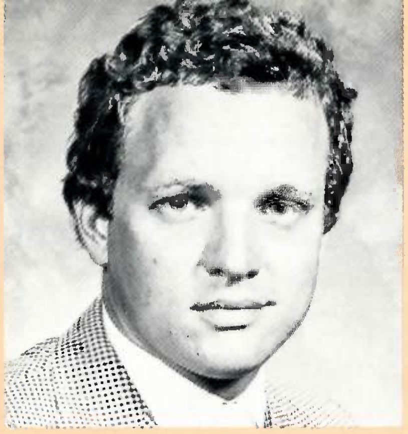
DAVID D.RESLER

David D. Resler has been appointed Southern District Sales Manager for Mueller Co. In his new position, Dave will direct field sales activity for Mueller Co. in the Southern District. He succeeds R. J. Ott who has been promoted to General Sales Manager.

A native of Decatur, Illinois, Dave graduated from Millikin University in 1960 with a degree in engineering administration. After graduation Dave joined Mueller Co. He completed an intensive sales training program, where he gained a thorough knowledge of the products for the water and gas industries. Dave then was assigned to our NO-BLO® Mobile Gas School.

In 1962, Dave was appointed a sales representative for the state of Mississippi in our Southern Sales District and served in that capacity until 1966 when he was transferred to Alabama. In 1973, Dave was promoted to the position of Central District Sales Manager where he has been located until the present time.

Dave is married and has a son and a daughter. Until the current school term is complete, Dave will be located in Elgin, Illinois.



FORREST N. BAUM

Forrest N. Baum has been promoted to the position of Central District Sales Manager for Mueller Co. In his new position, Forrest will direct field sales activity for Mueller Co. in the Central District. He succeeds D. D. Resler who has been transferred to the Southern District.

Forrest joined Mueller Co. in 1953 and worked in both the factory and sales office until he was selected as a sales trainee. He completed an intensive sales training program in 1962. Forrest has had extensive experience as a sales representative in the Southwest District, the Southern District and most recently in the Central District for the past seven years.

Forrest has a tremendous knowledge of both water and gas industries, and he will be looking forward to serving you. Forrest is married and has one son. His headquarters will be in Columbus, Ohio.

JOSEPH R. JAMES

Joseph R. James has been appointed sales representative for Mueller Co. in our Central Sales District. A realignment of territories for better service to our customers created this new territory.

A native of Greensboro, North Carolina, Joe attended Appalachian State University in Boone, North Carolina.

During the summer while in college Joe worked for utility contractors. After graduating with a Bachelor of Science Degree in Marketing in Greensboro, Joe worked for a leading waterworks distributor. Later transferred to Westerville he served as a sales representative in Central and Southern Ohio until he joined Mueller Co.

Since that time he has completed an intensive sales training program where he has gained a thorough knowledge of products for both the water and gas industries. This knowledge plus his previous experience makes him well qualified to serve you.

Joe is married and resides in Delaware, Ohio.

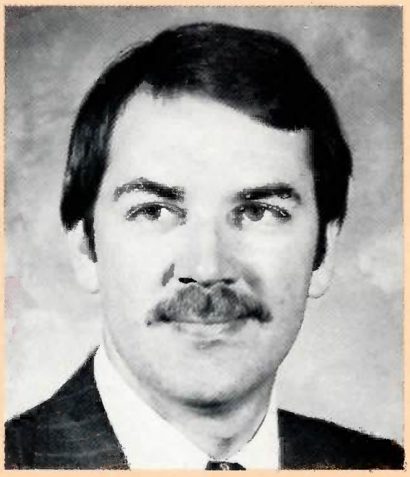
R. WM. HENDERSON

Bill Henderson has been appointed sales representative for Mueller Co. in our Southern Sales District.

A native of Maroa, Illinois, Bill joined Mueller Co. in 1965. As part of his work as a Senior Laboratory Technician, Bill has made many field service trips supervising the use of Mueller machines and equipment in "Line Stopping" and "Hot Tapping" jobs in both water and gas installation.

He has recently completed an intensive sales training program covering products for both gas and water systems.

Bill is married and has four children. His headquarters will be in Clinton, Mississippi.



DAVID B. ANDERSON

David B. Anderson has been appointed sales representative for Mueller Co. in our Midwest Sales District.

A native of Iowa, Dave is a graduate of Southeast Iowa University. Since graduation Dave has been serving as a sales representative for a leading waterworks distributor in Omaha. This experience has given him an excellent background for working with our water customers. Since joining Mueller Co. he has completed an intensive sales training program where he has gained additional knowledge of products for both water and gas industries. This knowledge, in addition to his previous experience, makes him well qualified to serve you.

Dave and his wife make their home in Omaha, Nebraska.

MUELLER CO., DECATUR, ILLINOIS

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