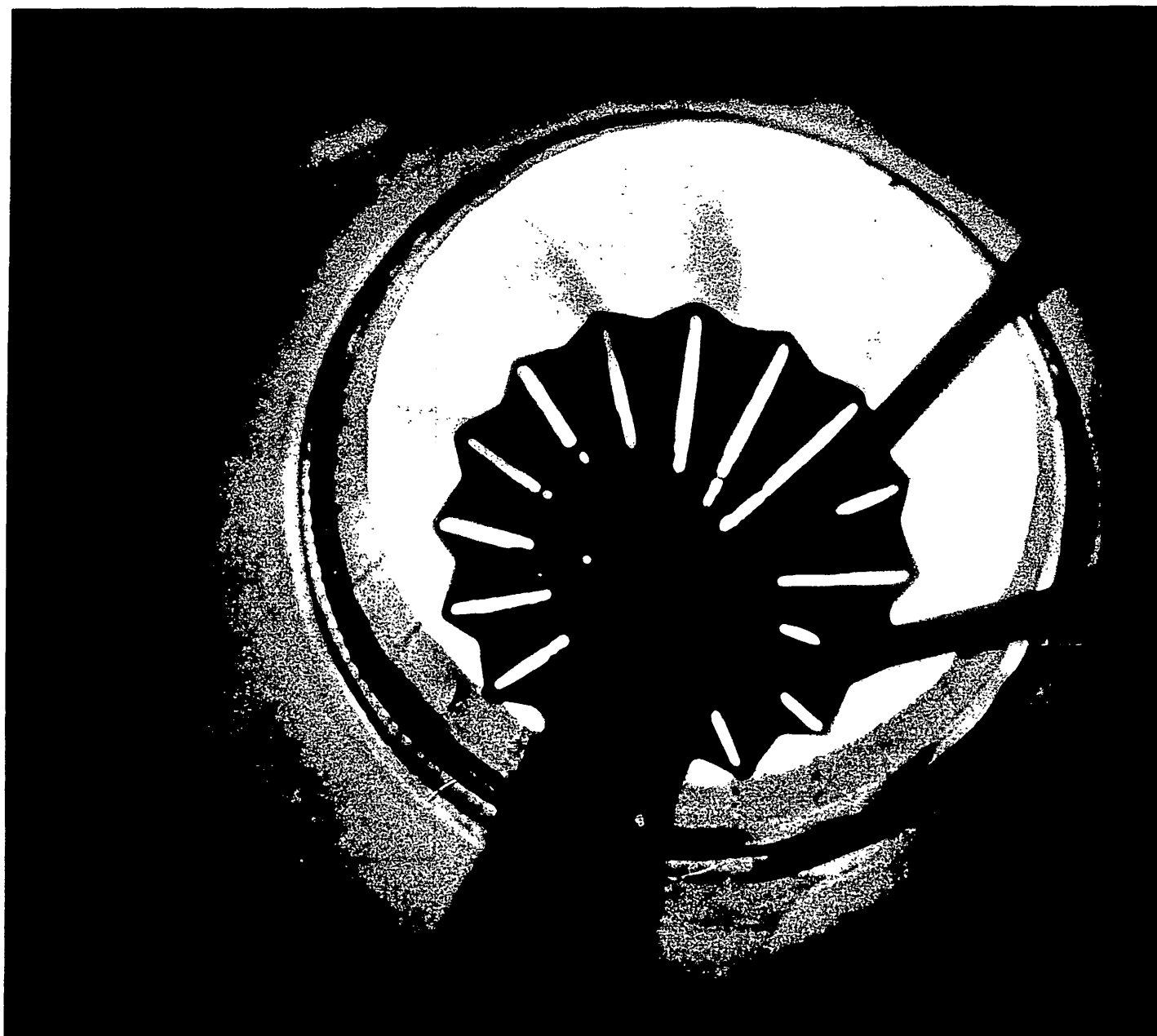


Photography by Orin A. Sealy



Downtown Denver's hot line

Doc Savage, Delgany plant foreman, sets boiler fuel pressure.



Photographer Orin A. Sealy's camera saw inside the boiler's roaring inferno—a blinding white glare to the human eye.

95% of the business district is heated by steam from a maze of underground pipes

By JOHN BUCHANAN

Empire Magazine



ON COLD DAYS have you noticed those wisps of vapor rising wraith-like from manhole covers in the streets of downtown Denver? Or, after a snow, have you wondered why, on those same downtown streets, there may be a wide band of black asphalt stretching ahead of you as you drive over packed snow?

Steam lines, buried beneath the surface of the streets, are responsible for both of these phenomena.

These steam lines, owned and operated by the Public Service Company of Colorado, are a part of that beneath-the-city maze that few people think about or even know about — a network of pipes and wires, power and telephone cables, water mains, sewer lines and even a few tunnels.

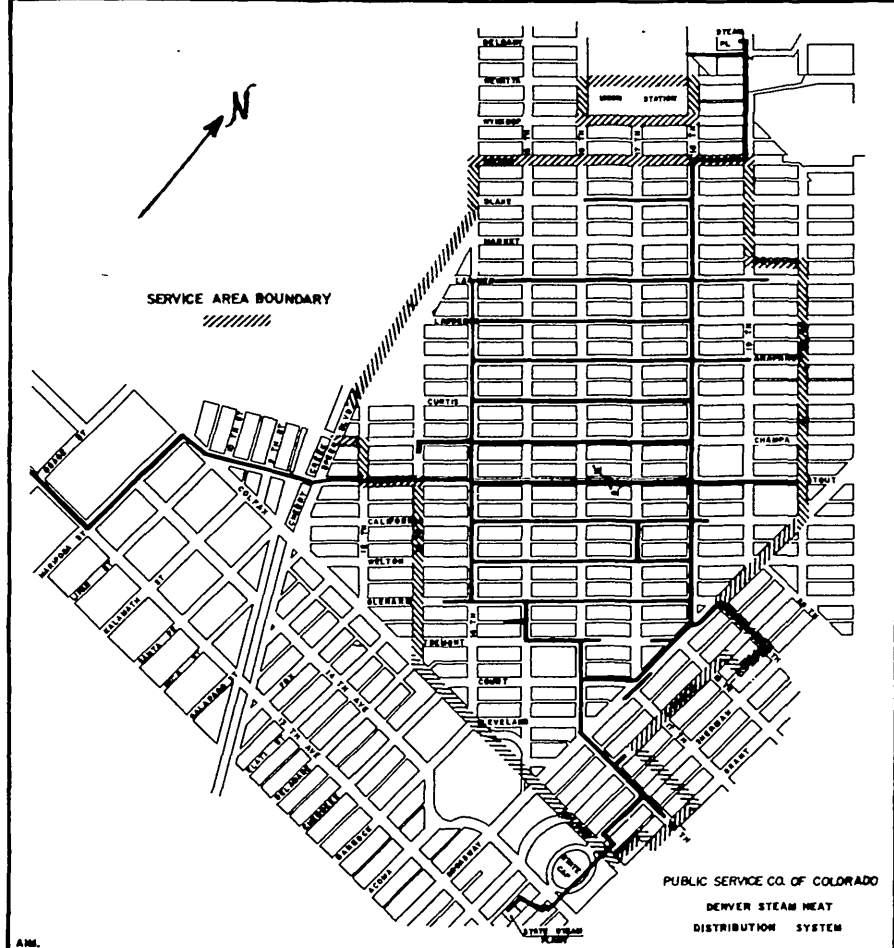
Extent of the steam lines probably would surprise most Denver residents. An estimated 95 per cent of heating in the 55 square blocks of the central business district is done by steam from these lines. Total length of the main lines is about 10 miles. Lines from the mains to buildings being serviced would add much more to this total.

Heating customers can use the steam in two ways: It can be piped directly through a steam heating and radiator system; it can be used to heat water, which in turn is piped through a radiator system.

There is yet another surprising fact: These same steam lines are used in many buildings to cool the air during hot weather.

Odd as it may seem, steam from these lines (in the main lines averaging about 445 degrees Fahrenheit and under about 40 pounds of pressure per square inch) is an excellent agent in air refrigeration. The process is called steam absorption cooling.





About 10 miles of steam main line (shown as solid black lines on the map) carry steam to smaller service lines (not shown) in the downtown district.

HOT LINE *continued*

What happens in cooling by steam is complex. Here is an oversimplified explanation: In this form of air refrigeration, water is cooled when it is absorbed into a brine. Steam is used to boil out the absorbed water from this brine, where the process can then be started all over again.

Heating and cooling of the Public Service Company's main office building at 550 15th St. is done by steam. The surprising fact is that it takes more steam to cool the building than it does to heat it.

The downtown district in which 95 per cent of the heating is by steam furnished by the company's three steam plants comprises an area roughly bounded by Speer Blvd., Wazee St., 19th and 20th Streets, Broadway, Lincoln and Grant Streets, and E. and W. Colfax Ave.

Among the major users are the state office buildings, the federal buildings, and most banks, hotels and major office buildings.

Roaring oil-fired or gas-fired boilers producing steam for the grid are located as follows:

The company's electric power generating facility (Zuni plant) at W. 13th Ave. and Zuni St.; the company's steam generating plant at

19th and Delgany Streets (site of Denver's first commercial steam heating plant); a steam plant at 1341 Sherman St. owned and at one time operated by the state of Colorado for its office buildings but now operated by the Public Service Company under a 30-year lease. The state plant was tied into the company's system in 1964.

Steam boilers at the United Bank of Denver and at the Hilton Hotel have capacities beyond the use of those buildings. The Public Service Company negotiated a contract to buy steam from these plants when necessary during periods of high use.

Largest producer of steam in all the facilities is the Zuni plant, although the new plant at 19th and Delgany Streets (a short distance north of Union Station) will move into first place when it is brought up to full capacity with addition of a second boiler late this year.

The Zuni plant can produce up to 270,000 pounds of steam per hour, the Delgany plant 130,000 pounds per hour now and 310,000 pounds when the second boiler is added. All facilities have a total capacity of about 560,000 pounds per hour.



Tunnels carry large steam lines to state office buildings including Capitol Bldg.

HOT LINE *continued*

At the Zuni plant, some steam for heating is taken off the turbines after contributing to the manufacture of kilowatts. But this is not surplus steam, the company points out. All steam for heating is manufactured for that purpose.

Most of the boilers are fed by oil. This type of fuel oil has the appearance of tar or oil used for asphalt paving. It is heated before pumping it under pressure to the burners in the boiler furnace. It is too thick to flow successfully without heating it.

Most of the boilers also have the capacity to operate on natural gas when surplus gas is available in the lines.

Either fuel turns the firebox of the boiler into a roaring inferno. The fuels, under pressure, create many flames similar, on a gigantic scale, to the flame from a blowtorch. Water, piped into the firebox, is turned to steam by the flames.

Steam leaves the boiler plants in lines varying in diameter from 14 to 18 inches. Downtown mains are from 6 to 12 inches in diameter. Some lines are buried as little as 4 feet below the surface of the street, while others are as deep as 12 feet.

Valves, unions and water-draining connections are located at intervals in the pipes. Concrete "boxes" are built around these connections in order to allow workmen to make inspections and repairs. Manholes lead from the surface of the street down to the work area.

Some of the vertical passageways are so narrow (cylindrical passages as little as 2 feet in diameter) that workmen have to be lowered by harness and cable into the work area. Fresh air must also be blown into the manholes to exhaust the heat and vapor and to keep the air fresh and cooled while work is done. Even then, some of the work areas remain unpleasantly warm.

Men never work in those areas without a companion standing up above, looking down the hole and talking. The men talk to make certain that the workman in the hole has not become faint or even unconscious from breathing the hot air.

The steam lines are insulated, most of them with fiberglass. There is still a loss of some heat from the plant to the customer. Most of all, though, there is a loss of pressure because of friction, just as there would be in a water line. Adequate pressure at the customer's site—about 60 pounds—starts out from the Zuni plant, for example, at about 250 pounds per square inch.

Vapor rising from manholes is not a loss of steam. It comes from hot water which has bled off from the lines.

Steam heating service began commercially in Denver a long time ago.

John W. Smith built Denver's first modern hotel, the American House, in 1869 at the corner of 16th and Blake Sts. (It was razed in 1933.) After it was built, he decided he would like to heat it with steam. None was commercially available.

Smith organized the Denver City Steam Heating Co. He built a steam generating plant at the site of the present Delgany steam plant near Union Station and went into steam production in 1879.

This plant, torn down just two years ago to make way for the new Delgany plant, produced most of the steam heat in the downtown system until about 1949. The Zuni plant took on most of the burden from that time on, producing steam for the heating system as well as for its electric power generating turbines.

The original plant was put on standby in 1953.

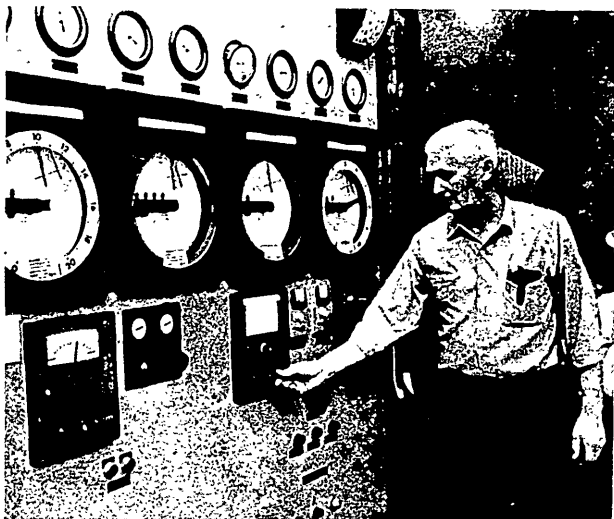
Steam from the Zuni plant travels 1.8 miles in a pipe 14 inches in diameter (up W. 13th Ave., Mariposa St. and Stout St.) before reaching the first customers in the vicinity of 14th and Stout Sts. Steam from the other two plants have much shorter runs.

Zuni is the control point for the system, calling for other points to increase output, decrease or shut off as demand rises and falls. Severe cold weather keeps most plants operating near capacity. But on a mild winter day, for example, the Delgany plant might operate only from about 6 a.m. to 10 a.m. when total use is customarily at its peak.

The new Delgany plant was completed just in time to meet increasing demands for downtown heating. It began putting steam into the system Dec. 5, 1972. The peak day for steam usage up to that time occurred five days later when, between 8 and 9 a.m., total consumption reached 451,000 pounds per hour. Capability of the entire system prior to then had been 435,000 pounds per hour.

Steam is a willing and versatile workhorse. It is hot, quiet, nearly invisible, on the move and powerful.

Jim Meehan, steam heat distribution engineer for the company, says that heating is the prime use for steam in the downtown heating network. But it is used for many other things in addition to heating and cooling.



Art Gottier, operator at the Delgany plant, can vary steam output by manipulating control panel.

HOT LINE *continued*

The *Denver Post*, for example, uses steam to humidify its press room in order to keep paper from becoming brittle. In reverse, dry steam (which is the way it is supposed to be at super-heated levels) can dry the air. Dry steam can even be used to dry ink in printing operations.

Restaurants use it for their steam tables and for cooking. Some have steam injection type automatic dishwashers. Many downtown buildings route steam through exterior downspouts during cold weather to heat them and to prevent a buildup of ice. A downspout clogged with ice might be pulled apart by weight of the ice. Or a clogged downspout could back up water into eaves troughs or under roofing and cause a lot of damage.

Humidity in computer rooms can be kept constant through the use of steam. Moisture must be kept at a constant level to keep tapes flexible and uniform in length.

One of the big jobs for the steam operation will be heating all of the buildings in the Skyline Urban Renewal District in downtown Denver. During early stages of this project, most streets were torn up. The Public Service Company took this opportunity to replace a number of old steam lines. Some dating back to the turn of the century were found to be insulated with an outer core made of oak.

Steam operations of the company will step outside the downtown core for the first time when service will provide to the Auraria urban redevelopment project getting under way west of the main business district. A new boiler plant may be built in the area.

The Public Service Company has one other steam heating operation. The company's wholly-owned subsidiary, Cheyenne Light, Fuel & Power Co., provides a steam heating system in downtown Cheyenne, Wyo. ■