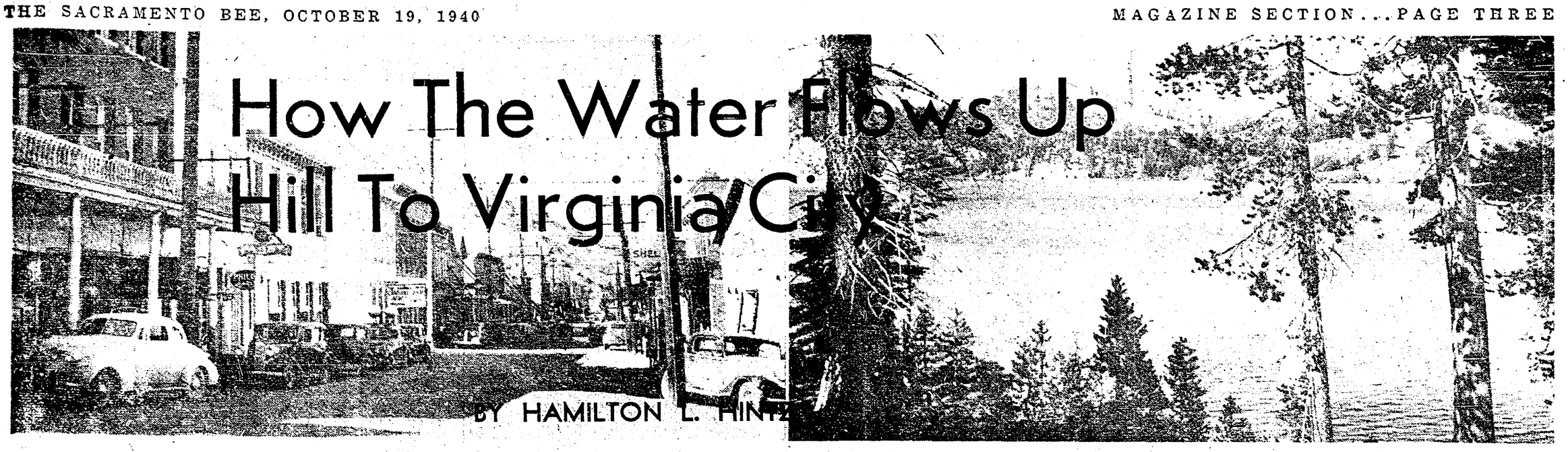

How The Water Flows Up Hill To Virginia City

BY HAMILTON L. HINTZ

In the blue panel above are seen the main street of Virginia City and Lake Marlette. Virginia City, remnants of a town of 42,000 in 1876, experienced a mild revival in recent years and many of the buildings of bonanza days have been pressed into use again. Lake Marlette, in the Tahoe Basin and 1,500 feet above Lake Tahoe, is the chief source of supply for the Virginia City system.

At the left is a sign which stands at Lakeview three miles north of Carson City on the Reno-Carson City Highway.

Bee Photos

At the right is a portrait of Hermann Schussler, daring engineer who designed and built the Virginia City water system, utilizing inverted siphon and pipe pressure features never before attempted any place in the world.

VIRGINIA CITY was drying up. Homes, schools and business houses were meagerly rationed with water of doubtful quality. Boilers, tanks and pipes at the mines were thin from corrosion and crusted with scale due to the action of undesirable matter in the water supply.

The bonanza mines faced shutdown, restriction of activities or expensive alternatives—the rapidly growing populace was in grave danger of water famine. In fact, the shortage of water had been acute for several years. What to do?

The metropolis of the Comstock Lode was entering her period of greatest growth and development which reached the peak population figure of 42,000 in 1876. The fabulously rich silver and gold mines were pouring forth their treasures at a rate which was a major contribution in the total all time Comstock production of $1,100,000,000.

It was in 1872 that the leaders decided to solve the perplexing problem and the resultant action of the then Virginia City and Gold Hill Water Company was characteristic of the vigor and courage with which the strong men of the West overcame obstacles in those hectic days. Money was no object—were not the Comstock mines yielding millions? Virginia City needed water and plenty of it; no undertaking was too difficult. The mines must continue, the city must not languish.

Consequently, Virginia City got water, plenty of it and of the best quality. It was obtained by a bold performance which provides one of the most dramatic chapters in the history of engineering and hydraulics.

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THE initial need for water in this district was during the period immediately following the discovery of the Comstock Lode on January 26, 1859, and the formation of the settlements of Virginia City, Gold Hill and Silver City. All three virtually join each other under the shadow of Mt. Davidson, 7,827 feet high and which overlooks everything else in that vicinity.

Ned Foster undertook to supply this need. He trapped water in springs and prospect tunnels on the side of Mt. Davidson and other nearby hills. Some of it he transported in containers on mule back to the town, some of it was stored in tanks and then allowed to flow through flumes to the town. En route much was lost from leakage and evaporation.

As the district grew the Virginia City and Gold Hill Water Company was formed and developed a system of small reservoirs, springs, tunnels, shafts, tanks and flumes in the surrounding hills.

All through the '60s it was a race between supply and demand, with the demand always far out in front.

New mines were developed, more people came to live there. Simultaneously the company's nearby water sources dried up one by one. There was no surcease; it was a continual struggle to find and develop new sources of water, not only to serve the new customers but to replace the sources drying up.

Large sums of money were spent in trying every conceivable system. Tunnels were run deep into the hillsides; open trenches were dug across flat places; every meadow was made into a reservoir; dams were thrown across dry canyons and ravines just to catch the runoff of rain water and melting snow.

Severe rationing often was put into effect. To make matters worse the water was impregnated with minerals and chemicals, including arsenic. It was not the type of water best suited to the human system, nor to the metal in pipes, tanks and boilers. But what was more alarming, the supply was rapidly dwindling in the face of an increase in population, mines and business enterprises. Something had to be done and done quickly, so they turned to the region of the eternal snows in the high Sierra above Tahoe.

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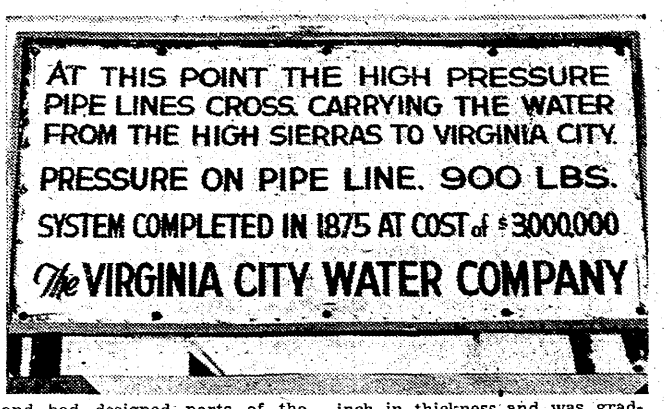
THE Sierra was twenty five miles away and the great depression of the Washoe Valley lay between it and the Virginia Range of Nevada in which were situated the Comstock Lode towns. How could Sierra water be brought all that distance and across that great depression?

The floor of the Washoe Valley was more than 2,000 feet below the surrounding mountains and about 1,500 feet below the elevation of Virginia City.

The water company already had received engineering reports on the venture, but in each case the engineers had feared to tackle a project which seemingly was so uncertain of success.

Then early in 1872 Hermann Schussler, eminent young engineer of San Francisco, was called in. He had designed and built many difficult features of the Spring Valley Water Company works supplying San Francisco and had designed parts of the waterworks for the great hydraulic mine at Cherokee, Butte County. This system employed some new features in hydraulics and utilized the highest pipe pressures known in the world.



Schussler looked over the previous reports and made a preliminary survey of his own, then rendered his report.

"Is this project feasible?" was demanded of him.

"It is," replied the 30 year old engineering genius.

"Then start at once," came the ready reply.

As casually as the financiers of the Comstock had inaugurated other great ventures, such as the Virginia-Truckee Railroad, Schussler was ordered to proceed.

While it was his job to lay out a system to collect and transport water in the Sierra in a series of reservoirs, small dams, flumes and a tunnel, the intriguing part of the project was to get the water across the Washoe Valley. There was no precedent for such a complicated undertaking, but Schussler was confident in his vision and his engineering figures.

He completed his surveys during the late Spring and early Summer of 1872 and for the Washoe Valley problem he designed an inverted siphon of nine miles of pipe to carry the water down the east slope of the Sierra to Lakeview, which is on a saddle in a low ridge separating the Washoe and Carson Valleys, then up the west side of the Virginia Range.

The blue line indicates the "profile" of the great nine mile siphon across Washoe Valley. The "pyramid" marks at the bottom of each depression denote water valves to drain off sediment. The "circle" marks on top of each crest denote valves to release air.

On this nine mile course the siphon pipe had to cross many ravines and go around many rocky points. Consequently specifications were drawn for each section of pipe so that when it was laid it would fit perfectly into its intended place. The iron was brought from Scotland and was fabricated in the Risdon Iron Works in San Francisco.

It required one year to manufacture the pipe, which was 12 inches in diameter, of varying thickness and held together by ¾ inch rivets. At the intake and outlet the pipe was 1/16 of an inch in thickness and was graduited up to 5/16 of an inch in thickness at the bottom of the siphon where the pressure would be the greatest.

The laying of the pipe began on June 11, 1873, and was completed on July 25th of the same year. Every length fit perfectly. It was laid in a trench two and a half feet underground. The intake in the Sierra side was 1,820 feet above the Washoe Valley, while the outlet on the Virginia Range side was approximately 300 feet below the elevation of the intake.

The pipe was to be subjected to the greatest pressure ever known, about 900 pounds per square inch, and it required strong fastenings to hold it down. Over each joint there was placed a cast iron sleeve weighing 300 pounds and each sleeve was filled with molten lead.

There was a total of 1,475 sleeves, weighing 442,500 pounds, put in place. The lead joints weighed 52,000 pounds. The pipe itself weighed 1,150,000 pounds and it had required 1,000,000 rivets in its fabrication. Before being put down each joint was given a bath in boiling asphaltum and coaltar at a temperature of 380 degrees.

A blowoff valve was placed at the bottom of each depression of the pipe to permit the draining off of sediment and the complete emptying of the pipe.

An air valve was placed at the top of each ridge to permit the expulsion of air compressed in the pipe at times the pipe was to be filled.

The construction phase of the great siphon was completed; a feat of hydraulic engineering never attempted before in any part of the world.

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MEANWHILE other interesting developments were going on. Provision had to be made to bring water to the siphon and to lead it away again.

This entailed a system of flumes, running in all directions and totaling thirty seven miles, four reservoirs and a tunnel through the Sierra.

Hobart Creek, which flows down the east side of the Sierra toward Washoe Valley, was dammed on its upper reaches to form a storage reservoir where once a large mountain meadow was situated. The stored water was to be let down the creek to a small control reservoir and thence by flume for five miles in a generally southerly direction to the intake of the siphon.

But this was not enough. Search was made for a large storage basin where a dam could be built to create a large reservoir. The services of S. H. Marlette, surveyor general of Nevada at the time, were employed to locate such a place, since he was familiar with the territory. He selected a large basin westerly across the Sierra range from Hobart Creek and on the east slope of the Tahoe Basin.

Here a 300 acre reservoir forty to fifty feet deep, storing more than 2,000,000,000 gallons of water, was created. It was named in honor of Marlette. From its outlet a flume was built northerly along the east rim of the Tahoe Basin, about 1,500 feet above Lake Tahoe and overlooking the lake all the way, for four miles to the west portal of a 4,000 foot tunnel which was bored in solid rock through the Sierra range to lead the water to the Washoe side of the mountains.

Another flume, ten miles long, was constructed from the Mt. Rose section southerly to bring water from the Mt. Rose drainage in the Tahoe Basin to the west portal of the tunnel, there to join with the water of the Marlette flume and pass through the tunnel and be picked up at the east portal by a single flume and led for eight miles southeasterly to the siphon intake. Midway Hobart Creek was crossed on a trestle just above the control dam for the original flume. The two flumes were built parallel to each other from Hobart Creek to the siphon intake.

In the Virginia Range a flume was built from the outlet of the siphon for four miles to a control reservoir and another stretch of flume five miles long was built from the control reservoir to a point on the slopes of Mt. Davidson 400 feet above Virginia City.

Storage tanks were built midway between the flume line and the town and from these there were built seventeen miles of water mains to supply the town. The reason the storage tanks were placed below the flume line was to reduce the pressure for domestic use.

After a fire in 1875 which destroyed much of the town, a $300,000 bond issue was sold, bearing the then going rate of interest of 12 per cent per annum, to finance the construction of a separate fire fighting system taking water from tanks on the flume line and thus gaining advantage of the full 400 foot drop pressure.

* * *

IT was August 1, 1873, and the great system was finished. Comstock Lode people were about to realize their ambition of having water "more copious and finer in quality than any other city, soft and pure as that distilled in the dews."

Schussler was a nervous man that day. Even though he had confidence that everything would work out the way he figured, there were so many new features involved—particularly the pressure on the pipe—he could not be quite sure until he actually saw water pouring from the siphon.

Taking a leaf from the book of the Piute Indians who inhabited that region, he had men stationed at every high point along the line of pipe to uncover signal fires as the water reached that station.

The climactic moment had arrived. The water was turned into the siphon. In succession the signal smokes lifted from the stations along the way, but it developed this was hardly necessary. As the water rushed with terrific speed and pressure down the siphon and then more slowly up the other side, the series of air cocks on the pipe lines began releasing the compressed air in the pipe, first one and then the next in rapid succession as the water progressed through the siphon. This set up such a terrific din that the entire countryside was filled with the noise and gave ample notice of the progress of the water.

Schussler was greatly relieved and there was high rejoicing in Virginia City when the water reached there. The town went wild and celebrated in true western fashion with parades, bands, flags flying, etc. The civic leaders met in the International Hotel, where a banquet and speech making were scheduled.

Shortly before Schussler's turn to speak a messenger, out of breath and excited, appeared at the rear door of the hotel.

"I must see Mr. Schussler," he demanded.

He was told Schussler was busy and that nobody could see him. But the man persisted until finally the great engineer was called.

"The pipe broke," was all the man could get out of his mouth when at last Schussler appeared. Schussler's heart sank and he left the hotel with his speech in his pocket.

* * *

SCHUSSLER obtained the fastest horses he could find and sped away in the night to the scene of the "break." Fortunately, it did not prove serious—one of the joint fastenings was not heavy enough and had broken loose.

Inspection revealed only three sleeve failures and one bad piece of pipe on the entire siphon. This was quickly remedied and the water system began a long and useful service.

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TWO years after the first siphon was put into service a second siphon pipe was laid under the direction of Captain J. B. Overton, who was superintendent of the company from before Schussler's time up until 1905. This was in 1875 and was a lap welded, screw joint pipe ten inches in diameter manufactured by the National Tube Company of Pennsylvania. This was laid alongside the first pipe and had the same capacity, even though two inches less in diameter, owing to the lack of friction which the rivet heads set up in the larger pipe.

In 1886 a third pipe was laid alongside the other two under the direction of Captain Overton. This was lap welded with converse lock joints, was fabricated in Pennsylvania and of twelve inch diameter. Each pipe is capable of delivering 2,200,000 gallons of water each twenty four hours. The entire system cost $3,000,000.

* * *

ALL three pipes as well as all the other parts of the system are still in use after nearly three quarters of a century, bringing cold, pure, sparkling water thirty one miles from the Sierra, and are performing a very necessary service what with the comeback the Comstock Lode has been experiencing the past few years. Improvements have been made from time to time and sections have been rebuilt when necessary, particularly the flume lines, but the system is in operation today much as it was back in the '70s and '80s when the eyes of the country were focused on the Comstock—days when the names of Sharon, Ralston, Flood, Fair, Mackay, O'Brien, Baldwin, Mills, Sutro, Bowers and many other bonanza era characters were on everybody's tongue.

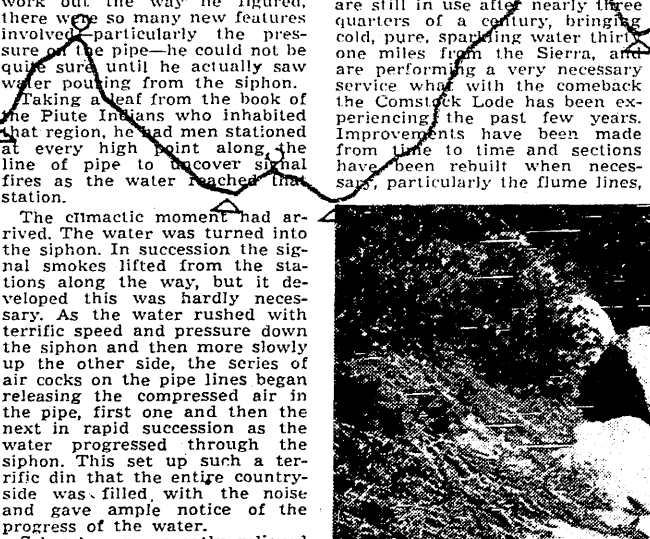
Schussler's name is still revered in San Francisco and Virginia City. Born in Rastede, Grand Duchy of Oldenburg, Germany, in 1842, he was educated in engineering in Zurich and Karlsruhe and had practical experience in Lucerne and Bremen before joining the Spring Valley Water Company in 1864 as assistant engineer. Two years later he became chief engineer, a position he held until 1908. His death occurred in 1919. He accepted many outside assignments during this period, one of which was to triangulate and correct the alignment of the Sutro Tunnel built by Adolph Sutro from near Dayton into the heart of the Comstock Lode to drain the water from the mines. Among the honors bestowed upon him was President Theodore Roosevelt's appointing him to the Panama Canal Board of Engineers and San Francisco erecting a monument to him at Lake Merced, the inscription of which says "If you seek his monument look about you."

A significant fact is the company, now known as the Virginia City Water Company, has had only two superintendents in its entire history. James M. Leonard, whose interest in the Sutro Tunnel took him to Virginia City at the turn of the century, became bookkeeper under Captain Overton in 1901.

Four years later when Captain Overton retired, Leonard became superintendent. Seven years ago he was advanced to the position of president, also retaining the superintendency until this year when his son, Hobart Leonard, was appointed superintendent.

From an office on the ground floor of an old time two story white building at 48 South B Street (this street is the same level as Lake Tahoe—6,225 feet), father and son direct the operations of this most unusual water system. A company telephone line keeps the office in touch with control and maintenance stations at strategic points along the flume system and pipe lines. Company roads lead to the stations and other points on the system to enable the moving of supplies for repairs.

And so because Schussler planned and built well and others have perpetuated his work, Virginia City still has water "soft and pure as that distilled in the dews."



The end of the water trail, thirty one miles from its source after traveling through flumes, a tunnel and the great siphon pipe. The storage tanks are along the flume line 400 feet above Virginia City and feed water into the town. Bee Photo

A section of the flume line which runs for four miles high above Lake Tahoe from Lake Marlette to the west portal of the tunnel. This section of flume is typical of the thirty seven miles of flume on the system. The flumes vary in width and depth depending on the load they carry, are covered and have a line of boards along the sides for protection from sun, dirt and snow. Bee Photo