

Chapter 9

HYDRAULIC MINING IN ARIZONA:

Using the Giant Monitor in an Arid Territory

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Hydraulic mining, according to most sources, is the one truly indigenous American mining technique, originating in the placer camps of California.¹ Although there is some disagreement among the authorities as to the individual responsible for the invention (or development) of hydraulic mining, most accept Edward E. Matteson but, as with most inventions, it appears that hydraulicking was the result of a series of contributions by Matteson, A. Chabot and Eli Miller while working a claim near Nevada City, California in 1852.² Regardless, it was quickly apparent that hydraulicking dramatically increased the effectiveness of placer mining. Using a rocker the average miner could work one cubic yard of dirt a day, with a tom two cubic yards, with a sluice four yards, hydraulic mining and a sluice, as much as one hundred cubic yards a day.³ With such impressive results hydraulicking quickly spread through the placer camps.⁴

However, for several reasons, the use of hydraulic mining in the placer camps of Arizona was somewhat delayed. Isolation was the biggest problem. Although the mineral deposits of the Verde Valley and the mountains to the West had been identified by the expeditions of Antonio Espejo and Juan de Oñate in the 16th century, they were too remote for profitable development. The first major placer strike in what became Arizona occurred in 1858 when Jacob Snively led a group of prospectors to a site on the Gila river about nineteen miles east of its juncture with the Colorado river. By 1861 the camp had a population of 1,000 miners.⁵ However, despite the announcement by the Gila City Gravel Mining Company in 1878 that it would re-open the camp using hydraulic techniques, hydraulic mining was slow in coming to the camp; more than three decades would pass before the giant monitor was used on the gravels of the Gila river.⁶

On February 14, 1863, President Lincoln signed the proclamation creating the Territory of Arizona, within months Joseph R. Walker led a party of prospectors from California up the Hassayampa river and into the mountains of west-central

Arizona. Finding gold in the streams of the region they established the Walker Mining District.⁷ Word of their find quickly spread and soon the mountains and streams were filled with prospectors. Placer claims lined the banks of Lynx, Big Bug, and Groom Creeks.⁸ Timber was readily available, water was plentiful for much of the year; the only problem was Indian activity. Despite persistent attacks and depredations by the Yavapai, the miners persisted. For the next few years the pages of the local newspaper are filled with accounts of successes and new strikes along the streams of the Bradshaw Mountains.⁹ The mining was typical of early placer mining; rockers and sluices were the means of collecting the gold. Even lode mining remained fairly simple, with water powered arrastras being the most commonly used crushing device. Gradually, however, articles began to appear in the newspaper of more extensive developments, flumes were built, canals were dug, and then improved. As the cost, and extent of development increased, companies formed to meet the need. Soon miners and companies were turning to California for advice and assistance.¹⁰ Despite extensive coverage of the mining activity and detailed descriptions of ditches and flumes, there is no mention, as yet, of any hydraulic operation. In February 1868 that changed.

The *Weekly Arizona Miner* issue of February 8, 1868, reported that William S. Little and Edward G. Taylor had purchased the Excelsior Ditch and Mining Company, located on Lynx Creek, for the sum of \$3,000.00. The brief article also said, they are from California and "will use hose and pipe to work down the bank."¹¹ By the 22nd of the month the *Miner* was reporting they had "commenced work in dead earnest" on their hydraulic work. According to the article they were using one hundred inches of water, forced from a 2-1/2 inch nozzle. Water was provided by a ditch carrying 125 inches of water but capable of delivering as much as 150 inches.¹² By early May Little and Taylor, using a work force of three men, were taking out \$115.50 a week. The following issue reported a clean-up of

\$150.00 for a five day week.¹³ Apparently their success was not lost on the other miners, the May 23, 1868 issue of the *Weekly Miner*, reported that Mr. M. Lewis, of Big Bug, had sent to California for "hydraulic fixings" to work his claim in Mexican Gulch of the Big Bug District.¹⁴ Despite these reports the summer of 1868 was not a good one for placer miners in the area. Lack of water and fear of Indians prevented much work.¹⁵ On August 8, the *Weekly Miner* reported the purchase of the Excelsior Ditch and Mining Company, this time by the company of Cal and Jackson, and said the new owners "have gone to work." The same issue also told of extensive ditch digging by two other groups.¹⁶ The following week the work done by Shoup, Griffin, and Lovejoy to begin "piping" was described. It concluded with the comment that "everything has been fixed up snugly and they are now tearing down the banks in regular Timbuctoo style." The following week they made their first clean-up, making \$15.00 a day to the hand. Lovejoy had already returned to California to purchase more hose and pipe.¹⁷ In mid-September the company extended its holdings on Lynx Creek, buying the claim and ditch of S. Z. Pierce, giving them "undisputed sway" over all these rich diggings. Once the water from summer rains receded they would begin cutting a new ditch, building flumes, and preparing for a "vigorous" winter piping.¹⁸ In December, Shoup, apparently needing money to develop another claim, sold one-sixth of his interest in the company to Lovejoy and Co. for \$2,000.00. Ready to begin work they began hydraulic operations in January but the driest winter in six years restricted their efforts. However, despite the lack of snow and bitter cold, they did manage to get some gold through February, averaging \$9.35 to the worker. Their persistence paid off; in April they hit "immensely rich dirt" paying \$30 to \$50 to the hand. Lovejoy brought \$1400.00 of gold dust to the store of Cook and Powers.¹⁹

Their success was not lost on other companies. The spring and summer of 1869 saw a spurt of hydraulic operations on Lynx Creek. It's not clear from the newspaper accounts that all the development was hydraulic but a number of ditches and flumes were being built and it's logical to assume, with the success of Jackson and Lovejoy, it was for hydraulics. By June, Edward F. Bowers, Superintendent of the Wells Hydraulic Mining Company, said he had completed one mile of ditch capable of carrying 500 inches of water and an additional one-half mile that could handle 300 inches. He was also building a large reservoir in Rich Gulch.²⁰

Although the 1870s started out with a serious dry spell by the middle of the decade hydraulic mining was again booming. It was reported that Lovejoy and Company, busily piping away, had enough gravel to keep one hundred men busy for the next fifty years. By 1874 the company was using three pipes. Smith and Company was working the claim just above them and Bashford and Company was still higher on the creek. Despite recurring reports of water shortage by the end of the year the *Weekly Miner* was able to state that "Lynx Creek is alive with miners who are taking out gold with arrastras, sluices, and the hydraulic process."²¹

Companies continued to move into the district; Smith and Marcutt in 1875 and then, in 1878, The Hassayampa Hydraulic and Mining Company, capitalized at \$5,000,000 (100,000 shares of stock at \$50.00 each) was incorporated on May 6, 1878.²²

As the prosperity continued into the 1880s several of the companies began to consider ways of insuring a more reliable supply of water. Early in the decade Calvin Jackson told of a twenty-four day run of \$2500.00, over one hundred dollars a day! The extent of the deposits was well known. An article in the reliable *Mining and Scientific Press* said the gravel's were "Perhaps the most extensive unworked beds of auriferous gravel on the Pacific coast between British Columbia and Mexico." Admitting that little had been done because of the lack of reliable water, it suggests that "by constructing dams in suitable places...mining might be extended...to two - three times the length of the rainy season." While the article was wrong on number of companies hydraulicking in the district, it said only F.M. Murphy and Co. was working the creek using a 14 inch pipe, its proposal for building reservoirs struck a responsive chord. By 1883 one company was proposing to buy the ranch in Walnut Grove and build a large reservoir.²³ As the last decade of the nineteenth century approached hydraulic mining in the mountains of north-central Arizona was set to enter a new and greatly expanded phase.

On February 17, 1883, Wells H. Bates registered a mining location claim at the Yavapai County Courthouse in Prescott claiming all of the water of the Hassayampa river for a hydraulic operation. Bates then filed a placer mining claim at the junction of the Hassayampa river and Fools Canyon Creek. From that initial claim Bates soon filed on sixty-three placer claims of 160 acres each extending west to the Weaver Creek.²⁴ The dam site for the project would be on the Abner Wade ranch in Walnut Grove.

By the end of the summer, with his claims staked, Bates went to New York City to get financing. New York financiers were not eager to invest and it took him two years to get the backing he needed but only by agreeing to an inspection of the site by a recognized mining consultant. By the end of February 1886 the inspection had been made, reporting gold averaging \$1.32 to the cubic yard of gravel, and the dam site approved. From the dam site in Walnut Grove valley there was a thousand foot drop to the placer sites, excellent for the pressure needed for their hydraulic operation. With this favorable report the financiers formed The Walnut Grove Water Storage Company.²⁵

That fall work began on the main dam. By December twenty-five feet of the designed eighty foot high dam had been completed. The estimated total cost was to be \$100,000.00 Early in 1887 a new superintendent changed the design to a rock fill structure and almost doubled its size, raising it to 110 feet, with a 410 crest. Two 20-inch pipes would discharge water into a 20 mile long flume at the base of the dam. This design leaked so badly that it was abandoned and a new dam built just behind the original site. The flume that was to carry the water to the placers was also a problem and was abandoned in September of 1888. Instead the company decided to let the water flow naturally to a diversion dam fourteen miles downstream. Then a wooden flume would carry the water the rest of the way to the placers.²⁶

In March 1889 heavy rains soaked the mountains. The resulting runoff filled the reservoir above the nine hundred acre level. Water rose to within a foot of the top of the dam. For the first time water ran through the spillway. By February 1890 the project was in its final stages, hydraulicking was scheduled to begin within the month.

At the same time an unusually intense storm hit the California coast. By Monday, February 17 it was moving across the Sierra Nevadas and into western Arizona. By Tuesday, February 18 the rain had reached the Bradshaws. The torrential rain continued in the Bradshaws until Friday. The unusually heavy rain of the previous December had saturated the ground. The four hundred square mile drainage area could not absorb the additional water.

Shortly after midnight on February 22 the dam broke. Most accounts put the time at 1:45 A.M. The entire dam appeared to move downstream, carrying everything with it. The level in the reservoir dropped so quickly the boats were stranded where

they were. Within two hours the reservoir was empty.²⁷ Estimates of the number killed varies from 76 to 120. The Walnut Grove Water Mining Company declared bankruptcy. Bates later said "no cut masonry, dams will ever be built in Arizona. The cost is too great."²⁸ However, despite Bate's predictions, plans were already underway for a similar dam on Lynx Creek.

Organized by Nathan O. and Frank Murphy, using their holdings in The Excelsior Ditch and Mining Company, the Lynx Creek Hydraulic Mining and Water Storage Enterprise, envisioned a project very similar to the Walnut Grove Dam operation. In a prospectus compiled by N.O. Murphy the history and potential of the district proposed three different dam sizes, 50 foot, at a cost of \$9,528.00; 60 foot, costing \$15,810.00, and a 75 foot costing \$28,578.00. The 75-foot dam would supply one thousand miner's inches of water for 340 days a year, a vast improvement over the current seventy day season.²⁹ Apparently effective, in March they managed to get an English syndicate to become the principal investors in the project.³⁰

By mid summer work surveyors were busy on the preliminary work. Work on the dam, designed for a height of 65 feet, was pushed rapidly, too rapidly. In November, pouring too much concrete without allowing sufficient curing time, a large section of the dam collapsed. The dam was the key to the entire project. Using Portland cement and masonry it would eventually be 45 feet thick at the base and eventually 65 feet high, although only 43 feet was scheduled to be finished in 1890. This massive structure would seal off Lynx Creek below Bigelow Flat. Controlling the water by an iron gate, the water would flow by pipe and ditch to the working head 270 feet above the creek. From there the water was distributed to the hydraulic giants.³¹

By January 1891 the system was in operation. There was only 18 feet of water behind the dam. They had to use the old ditch, and they had to shut down at night to replenish the water, but they were washing gravel. However, a flood in February seriously damaged the dam, temporarily halting operations. A second flood a month later added to the damage. By April they were able to run the system for part of each day.³² Pedley and Thomas G. Barlow-Massicks (the British investors) remained in the area, Barlow-Massicks had built a large Victorian house near Prescott, and continued efforts to work their mines but the dam was never repaired.³³

Hydraulic mining continued on Lynx Creek but on a much reduced scale. In 1897 a giant monitor that had "been operating for some time" was moving 1,000 yards of gravel a day. James Hall, the father of Sharlot Hall, is also reported to have operated a hydraulic system on the creek in 1899 but no details are available.³⁴ However, hydraulicking was not restricted to the mountains of north-central Arizona, the tremendous profits to be realized by the process led to its use in a number of other placer camps, some of them quite old.

Meanwhile on Humbug Creek, on the southern edge of the Bradshaws, an equally ambitious hydraulicking effort was underway. This project has its beginning in 1886 when Daniel Keating recorded four placer claims in Prescott. Using family and friends he proceeded to record a number of additional placer claims until he had control of 4.5 square miles along Humbug Creek. In 1888 he recorded two water claims, one claiming 5,000 miner's inches from Humbug Creek and the other claiming its tributaries.³⁵

At the same time three men in Maine were busy organizing a company to mine the gold of Humbug Creek. On July 17, 1888, they incorporated the Yavapai Mining and Irrigation Company. Keating's name was not listed on the articles of incorporation. Keating's connection was as statutory agent in Arizona.³⁶

A year later the *Phoenix Herald* reported their plan to build a two mile long ditch capable of carrying 1,000 miner's inches of water. Again Keating is not mentioned but he had rerecorded his water rights along the creek.³⁷

In April 1890, Keating was in London busy looking for English investors. Successful, he was able to get Alfred Borwick and August G. Meissner to invest \$10,000.00 in the company. In July of that year the company was sold to another group led by Richard L. Hattersley. Soon after, the camp, known until this time as Keatings Camp, became identified as Camp Hatterly.³⁸

By October 1890 Camp Hatterly's was described as a "model camp," with the *Arizona Journal Miner* saying it was one of the best arranged, equipped, most substantial camps in the territory. The same article provided details of the extensive ditch and flume system, describing a ditch of one and half miles, cut through solid rock, requiring 473 feet of tunnel and over 1300 feet of flumes. The system had a capacity of 2,500 miner's inches of water.

Water storage was provided by a main dam 100 feet long, 15 feet thick, and 30 feet high.³⁹

In March 1891 water flowed from the dam into the giant. The platform mounted giant threw a five inch stream of water 100 feet, washing the gravel into a sluice laid in the bottom of the stream. An article in April said Keating was operating around the clock with "great success."⁴⁰

Keating's success, however, must not have been as great as the newspapers believed, for in July 1891 he left for London to meet with his English investors, leaving George Borwick, Alfred's son, in charge. That same month George Borwick wrote a lengthy letter to his father describing apparent mismanagement by Keating. Before the end of the month the English owners of the company fired him.⁴¹ However, that did not resolve the companies financial troubles. In October employees and debtors began suing the Yavapai Mining and Irrigation Company for back pay and debts. When L.W. Blinn Lumber Company of Phoenix sued for nonpayment of bills for lumber and hardware in December, no one was available to represent the company.⁴²

While he was developing the Yavapai Mining and Irrigation Company, Keating was also acquiring mining and water rights to develop other hydraulic operations. He secured rights to 5,000 inches of water from the Agua Fria river, claims on French Creek in the Humbug District. None of these claims or rights were ever developed.

Although described by J. Ross Browne as consisting of "three chimneys and a coyote" in 1864, mining continued on a limited scale in Gila City until the 1890s.⁴³ A company named the Gila City Gravel Mining Company announced plans to use hydraulicking in 1878 but never went beyond the planning stage.⁴⁴ The first realistic effort to use the hydraulic method occurred on April 4, 1891, when George "Buck" Kelley, a newspaper publisher from Moberly, Missouri, demonstrated the effectiveness of the giant monitors to an assembled crowd of Yuma citizens. His efforts resulted in an immediate boom for Gila City. In fact, he was so successful he invited President Benjamin Harrison, who was stopping briefly in Yuma, to a demonstration. Harrison never appeared, possibly because his stay in Yuma was only 30 minutes. Kelley's success was short-lived, a year later his pumps were not operating and the camp was again using dry washers to find the gold.⁴⁵ Kelley, however, continued his efforts to interest investors in his operation. For the

next several years he traveled between Gila City, Los Angeles, Denver, and Moberly trying to arouse interest in Gila City. In December, 1891 E. H. Merriam and L.C. Moreland of Los Angeles after visiting the camp, apparently saying "The placers are rich and with proper care are sure to be productive for many years to come." The following week the newspaper reported that L.C. Moreland, "a mining man of experience" had taken charge of the mine "which means they will be more productive."⁴⁶ Despite his best efforts Kelley remained in control of the mine. In December 1892, he was in Los Angeles buying supplies for the mine. Almost a year later he wrote from Moberly that he expected to visit Yuma soon with "several prominent eastern capitalists" and the Monitor Mine would open up again.⁴⁷ It seemed his efforts had succeeded when James Sanderson, also of Moberly, arrived and announced he had purchased Kelley's interest in the mine. However, in April 1904, Kelley was back in Gila City and saying he had leased the mine to Mrs. Ford, Anderson and Ladd. They were sinking a larger well, saying the mine had not been profitable in the past because the it was too high above the Gila river. Finally in early 1905 the newspaper reported that a company was being organized, using Los Angeles, San Francisco, and Yuma money to work the placers. But they too were destined to fail. Gila City died a second time.⁴⁸

As Arizona entered the twentieth century hydraulic technology had advanced to the point that even in more arid regions of the territory, companies were using the giant monitor. Eventually hydraulicking would be attempted, usually unsuccessfully, in ten of the fourteen counties of Arizona.⁴⁹

The modern hydraulic operation was much more precise than those which merely directed a stream of water against a bank. Not only had the equipment improved, giants could swivel through a 360 horizontal degree plane but could also be moved vertically 60 degrees, 50 degrees up and 10 degrees down. Nozzles could deliver water in a straight, direct, unbroken line that carried 50 to 150 feet to the face of the bank. Indeed, it was wise not to work too close to the bank. Experience had taught that working into a bank with a "horseshoe" cut was not only inefficient but dangerous. Where natural water resources did not provide a sufficient head of water, two-stage centrifugal pumps were capable of providing enough water pressure.

Ironically, the most important part of the operation was the correct use of a device that actually preceded the use of the giant monitor, the sluice. "The suc-

cess or non-success, however, of all hydraulic mining work will depend very largely upon the proper construction of the sluice boxes and their grade and location." The amount of water available determined the width of the sluice box. A water supply of 300-400 cubic feet per minute could be handled by a 24-inch-wide box, while 4500 cubic feet per minute required a box of 60 inches. The ideal grade for the boxes was five to seven inches per 12 feet. Generally short sluice boxes were more efficient than long ones. The final factor to consider was disposal of the tailings. They had to be efficiently moved out of the immediate area without polluting the creek or river; usually brush dams were constructed for this purpose.⁵⁰ However, even with modern equipment and knowledge of its use, hydraulic mining in the twentieth century would rarely be successful in the water shy camps of Arizona.

One of the most successful of the twentieth century hydraulic operations was in a camp where placering dated back to the 1874, the Greaterville placers in the Santa Rita mountains south of Tucson. By 1886 the district was believed worked out and little was done until 1900.⁵¹ The first attempt at hydraulicking was in Kentucky Camp in 1900. The Stetson Company developed an eight mile long pipeline that delivered a 125 foot head of water.⁵² There is no record however, of the success of this company. In 1902, George B. McAneny and four other investors incorporated The Santa Rita Water and Mining Company. Construction on ditches and pipelines proceeded quickly. Constructing a series of small dams, they built ten miles of canals and pipelines to the workings. By August 1904 the company had three giants in operation and was "tearing up the ground with splendid results."⁵³ Although enjoying success, they soon sold out to Gadsden Purchase, Inc.

At the same time, another company built an eight mile pipe line to the junction of Kentucky and Boston Gulches for a hydraulic operation there. Because of the coarseness of the gravel and the amount of overburden, they soon ceased operations. Placering continued in the camp but there is no report of any further hydraulic operations.⁵⁴

The first three decades of the twentieth century saw hydraulic operations attempted in a number of sites widely scattered around Arizona, none with any apparent success. In Yuma county near the site of the old La Paz placer diggings of 1863 an attempt was made by the La Paz Gold Mining Company to dig wells and pipe water to tanks above the mines

but when the land was returned to the Indians the activity ceased. In 1931, Gila City was again the scene of mining activity. G.H. Mears pumped water from a well to Monitor Gulch in an unsuccessful attempt to work the mines there.⁵⁵

Maricopa County saw several attempts along San Domingo Wash, a tributary of the Hassayampa river. A dam was built in 1910 but most of the operations never got beyond the sluicing stage.⁵⁶

In Pinal County the old Cañada del Oro or Old Hat placers near Oracle reported a very brief effort to use a boiler and pump to throw water against a bank but lack of water quickly ended the enterprise.⁵⁷

The counties on the eastern and southeastern part of Arizona also saw hydraulicking efforts. Near Oroville in Greenlee County, near the turn of the century, an expensive pipeline was built into the area but it could never develop adequate head pressure and there was lack of space for waste.⁵⁸ In nearby Graham County, one of the few reports of a successful hydraulic operation was identified in 1928 when it was reported that E.W. Hartman was "operating the only successful hydraulic in Arizona" on the Gila river near Safford.⁵⁹ In Cochise County in extreme southeastern Arizona three different companies tried hydraulicking in Ash Canyon by pumping water from springs and wells. Despite having a wet year the operations produced very little gold.⁶⁰

Finally, Mohave County had an unsuccessful attempt at hydraulicking at Temple Bar in 1935. Earlier, in 1895, a hydraulic operation using two wheels which raised the water to a height of 250 feet and then ran it through nozzles had been used on the Nevada side of the river.⁶¹ However, 1935 is the last account of any effort to use hydraulic mining in Arizona.

It is impossible to determine the impact of hydraulicking on the placer mining output of Arizona. Although gold production was recorded, it did not distinguish, except for placer, the technique used to produce the gold. For the period before 1900, Wilson identifies production by districts, indicating approximately \$1,000,000 each from Lynx Creek, and the Big Bug, Groom Creek, Hassayampa, and Minnehaha camps, \$700,000 from Greaterville, and \$500,000 from Gila City, for a total of \$3,200,000. However, this covers a forty-two year period, of which hydraulicking was only used, at most, two decades. The figures for the first third of the twentieth century are equally vague; with much of the gold production coming from sil-

ver and copper operations.⁶² Ayres only identifies three "successful" hydraulic operations in Arizona; Lynx Creek, Greaterville, and an unidentified operation north of Safford.⁶³ However, whether successful or not, hydraulic mining was a significant part of placer mining at the turn of the century. There is no doubt that it attracted many investors and much capital to the territory during its brief existence and the accounts of the men, mines, and giant monitors desire more attention than they have received.⁶⁴

Footnotes

1 May, Philip Ross, *Origins of Hydraulic Mining in California* (The Holmes Book Company, Oakland, Ca., 1970), *passim*. Paul, Rodman W. *California Gold: The Beginning of Mining in the Far West* (University of Nebraska Press, Lincoln, 1965), pp. 152-170. Kelley, Robert L., *Gold vs. Grain: The Hydraulic Mining Controversy in California's Sacramento Valley* (The Arthur H. Clark Company, Glendale, Ca., 1959), pp. 26 - 29. Macdonald, Eoin H., *Alluvial Mining: The geology, technology and economics of placers* (Chapman and Hall, Ltd., New York, New York, 1983), pp. 342-347. Young, Otis E. Jr., *Western Mining: An Informal Account of Precious-Metals Prospecting, Placering, Lode Mining, and Milling on the American Frontier From Spanish Times to 1893* (University of Oklahoma Press, Norman, Ok., 1970), pp. 125-131.

2 May, *Origins of Hydraulic Mining*, pp.40-43. According to May, Chabot began the process by designing a length of hose, Miller, a tinsmith, made a tin funnel and Matteson improved the funnel by suggesting a tapered end, thereby increasing water pressure. Paul, *California Gold*, pp. 152-153, while stating that Chabot used a hose to direct water against a bank, credits Matteson with the invention of hydraulicking. Young, *Western Mining*, includes a description of Pliny's account of Roman hydraulicking in Iberia and indicates that this is the origin of hydraulic mining but what Pliny was describing is more accurately identified as ground sluicing. While ground sluicing dates from Roman times and was possibly important in developing the idea of using water to wash out gold, it was not using water under pressure, or being directed against a specific point, essential to the concept of "hydraulicking."

3 Brown, J. Ross, and James W. Taylor, *Reports Upon the Mineral Resources of the United States*, Washington, D.C., 1867, p. 22.

- 4 There were, however, several negative aspects to the use of hydraulic mining; it was terribly destructive, eroding the stream banks and filling the downstream areas with debris and, as the technique was refined, it became terribly expensive. For hydraulicking to be effective massive amounts of water had to be impounded, requiring large reservoirs. Also, as the systems expanded, the canals, flumes, and pipes necessary to deliver the water under pressure became more elaborate, often carrying water for miles before it could be used. All of this required massive capital investment and took the process out of the capabilities of the average miner. Paul, *California Gold*, pp. 155-170.
- 5 Browne, J. Ross, *Adventures in the Apache Country: A Tour Through Arizona and Sonora, 1864* (Tucson: The University of Arizona Press, 1974), Re-edition, intro. by Donald M. Powell, p 76.
- 6 Love, Frank. *Mining Camps and Ghost Towns: A History of Mining in Arizona and California Along the Lower Colorado* (Los Angeles, Westernlore Press, 1974), p23.
- 7 Connor, Daniel Ellis, edited by Donald F. berthrong and Odessa Davenport. *Joseph Reddeford Walker and the Arizona Adventure* (University of Oklahoma Press, Norman, 1956), pp. 83-105. Journal of the Pioneer and Walker Mining Districts ,1863-1865. Yavapai county Recorder's office, Prescott, Arizona.
- 8 As a result of the growth of mining, as well as a desire to place the seat of government as far as possible from the Southern sympathizers in Tucson, General James H. Carleton located the territorial capitol in the area. Prescott soon became the focus for mining activity in the new territory.
- 9 *The Weekly Arizona Miner*, 1864-1867, passim.
- 10 *Weekly Arizona Miner*, March 28, May 9, 1866, December 28, 1867.
- 11 *Ibid.*, February 8, 1868.
- 12 *Ibid.*, February 22, 1868.
- 13 *Ibid.*, May 9, May 16, 1868. The articles are worded very similar and it may be that the paper is reporting the same work twice. Each account said three men and five days work. However, the second article did say they were cleaning that much out of their sluices.
- 14 *Ibid.*, May 23, 1868.
- 15 *Ibid.*, June 27, July 4, 1868.
- 16 *Ibid.*, August 8, 1868.
- 17 *Ibid.*, August 15, 22, 1868. Apparently the sale had been in the works for some time. The May 9, issue of the *Weekly Miner* said Cal Jackson had returned from California accompanied by Lovejoy and two others.
- 18 *Ibid.*, September 19, 1868.
- 19 *Ibid.*, December 19, 1868, January 9, 16; February 6, 27; April 10, 24, 1869.
- 20 *Ibid.*, May 15, June 12, 17, 1869. Potter, Alvina N. *The Many Lives of the Lynx: A Century of Mining on Lynx Creek Between 1863 and 1963*. (No Publisher, Prescott, Arizona, 1964), p. 47.
- 21 *Weekly Miner*, March 15, 22; April 5, 1873; January 23, 30; December 1, 1874. Potter, *Many Lives of the Lynx*, pp.47-48.
- 22 *Ibid.*, January 26, 1875; May 27, 1878
- 23 *Phoenix Daily Herald*, April 5, 1880. *Mining and Scientific Press*, July 21, 1883, p. 34; June 13, 1885, p. 382.
- 24 *Mill Sites and Water Rights Book 1*, p. 106; *Deed Book 13*, p. 264; *Deed Book 18*, p. 99; *Deed Book 19*, p. 264, Yavapai county Recorder's office.
- 25 David B. Dill, Jr., "Terror on the Hassayampa: The Walnut Grove Dam Disaster of 1890," *The Journal of Arizona History*, (Autumn 1987): pp. 285-286.
- 26 *Ibid.*, pp. 289-291. The dam had a series of construction superintendents, eventually being finished by Alexander O. Brodie, a West point graduate who had been an assistant engineer on the project.
- 27 *Ibid.*, pp. 296-298.
- 28 *Ibid.*, Bates quote, unidentified and undated newspaper clipping, Walnut Grove Dam file, Sharlot Hall Museum,
- 29 Nathan O. Murphy, comp., *Lynx Creek Hydraulic Mining Water Storage Enterprise, Illustrated, located near Prescott, Yavapai County, Arizona*. No date, no publisher, Cline Library, Northern Arizona State University, p.9.
- 30 Potter, *Many Lives of the Lynx*, pp. 48-49. While Potter told of "English capital...looking for

opportunities for investment," the editor of the *Engineering and Mining Journal* in the July 23, 1881, issue said "of all the large class of idiotic capitalists, the Britisher shows the least symptom of intelligence."

31 *Potter*, pp.48-50

32 *Ibid.*, p.51.

33 *Ibid.*, pp. 52-53. Barlow-Massicks continued mining, invented a massive shovel for working the streams of the area, and encouraged wealthy English friends to invest in mining ventures but never rebuilt the dam. He entertained lavishly, even had cricket matches at his home and became part of Prescott social life. In 1898, while riding his buckboard home from one of his mines, a gun jostled out of its holster, accidentally discharged and wounded him. Taken to Mercy Hospital in Prescott he died there on April 13, 1899.

34 *Ibid.*, p.54. Ayres, James E., et al., *Humbug!: The Historical Archaeology of Placer Mining on Humbug Creek in Central Arizona*, Prepared for U.S. Bureau of Reclamation, Dames and Moore, Phoenix, Arizona, August 1992, p.22.

35 Ayres, *Humbug*, pp. 35-36.

36 *Ibid.*, p.36.

37 *Ibid.*,

38 *Ibid.*, 37.

39 *Ibid.*, p. 38; *Arizona Journal Miner*, October 25, 29, 1890; *Weekly Phoenix Herald*, October 30, 1890.

40 *Ibid.*, *Arizona Republican*, April 15, 1891. Although the actual location of the giant could vary, optimum operation of a giant was achieved by having a slight downward angle before the nozzle and securing it to a platform so it could not creep. Griffin, *Alluvial Prospecting and Mining*, pp. 152-154; Wilson, *Hydraulic and Placer Mining*, p.213.

41 *Ibid.*, p.40.

42 *Ibid.*, pp.41-42.

43 Browne, J. Ross, *Adventures in The Apache Country: A Tour Through Arizona and Sonora, 1864* (University of Arizona Press, Tucson, 1974), re-edition, p. 77. Love, *Mining Camps*, p.23.

44 *Mining and Scientific Press*, March 2, 1878, p. 132. Love *Mining Camps*, p.23. *Arizona Sentinel*, April 4, 1891, p.3.

45 Love, *Mining Camps*, pp.23-24. *Arizona Sentinel*, April 18, 1891, p.3.

46 *Arizona Sentinel*, December 5, 1891, April 30, 1892, February 10, 1894, November 21, 1891, December 12, 1891, January 30, 1892, February 27, 1892.

47 *Arizona Sentinel*, December 10, 1892, October 21, 1893.

48 *Arizona Sentinel*, December 26, 1896, April 6, 1904, February 1, 1905. Love, *Mining Camps*, pp. 23-27.

49 Ayres, *Humbug!*, p. 20. Ayres says 10 of 15 counties but La Paz county was not created until 1892, long after the events described in this paper, so I have only counted the counties that existed during the period written about.

50 Griffith, S.V., *Alluvial Prospecting and Mining* (Oxford, Pergamon Press, 1969), 2nd revised edition, pp. 150-171. This brief chapter on hydraulic mining, written more for the engineer than the historian, has an abundance of charts and tables providing information on specific pressures, angles, and distances for optimum movement of gravel. Eugene B. Wilson, in *Hydraulic and Placer Mining*, 3rd ed., (John Wiley & Sons, Inc., New York, 1918), in chapter II, "Hydraulic Mining," distinguishes between "hydraulicking" and "hydraulic mining," restricting hydraulicking to gold mining and the term hydraulic mining to cover "all materials mined by the use of water". p.50. Ayres, *Humbug!*, figure 4, p.16.

51 Wilson, Eldred D., *Gold Placers and Placering in Arizona*, Arizona Bureau Of Mines, Bulletin Number 168, Tucson: University of Arizona, 1961, p. 72.

52 Ayres, *Humbug!*, p. 25. H. Mason Coggin, "A History of Placer Mining in Arizona", p. 180, in J. Michael Canty and Michael N. Greeley, eds., *History of Mining in Arizona*, Tucson, Mining Club of the Southwest Foundation, 1987.

53 Farrell, Mary M., et al., *Tearing Up The Ground With Splendid Results: Historic Mining on the Coronado National Forest*, Heritage Resources Management Report No. 15, USDA Forest Service Southwestern Region, September 1995, pp.49-60. *Arizona Daily Star*, August 15, 23, 1904.

54 Wilson, Bulletin #168, p. 72.

55 *Ibid.*, pp. 18-19, 26-28.

56 *Ibid.*, p. 59-60.

57 *Ibid.*, pp.61-62.

58 *Ibid.*, pp. 65-66.

59 Ayres, *Humbug!*, p.25. Ayres says "the only successful hydraulic mining operation in Arizona," but the *Mining Journal* says "Mr. Hartman is also working the only hydraulicking operation in Arizona,...He owns a large area which is being successfully worked." Efforts to identify the site of this operation, the name of the company, or to get more information on E.W. Hartman have all ended in failure. Several mines were incorporated in the area but he was not a member (at least not identified on the list of officers) of any. Reports of mining on the Gila River at this time locate the mines on the north side of the river between Bonita and Spring Creeks.

60 Wilson, *Gold Placers and Placering*, pp. 69-70.

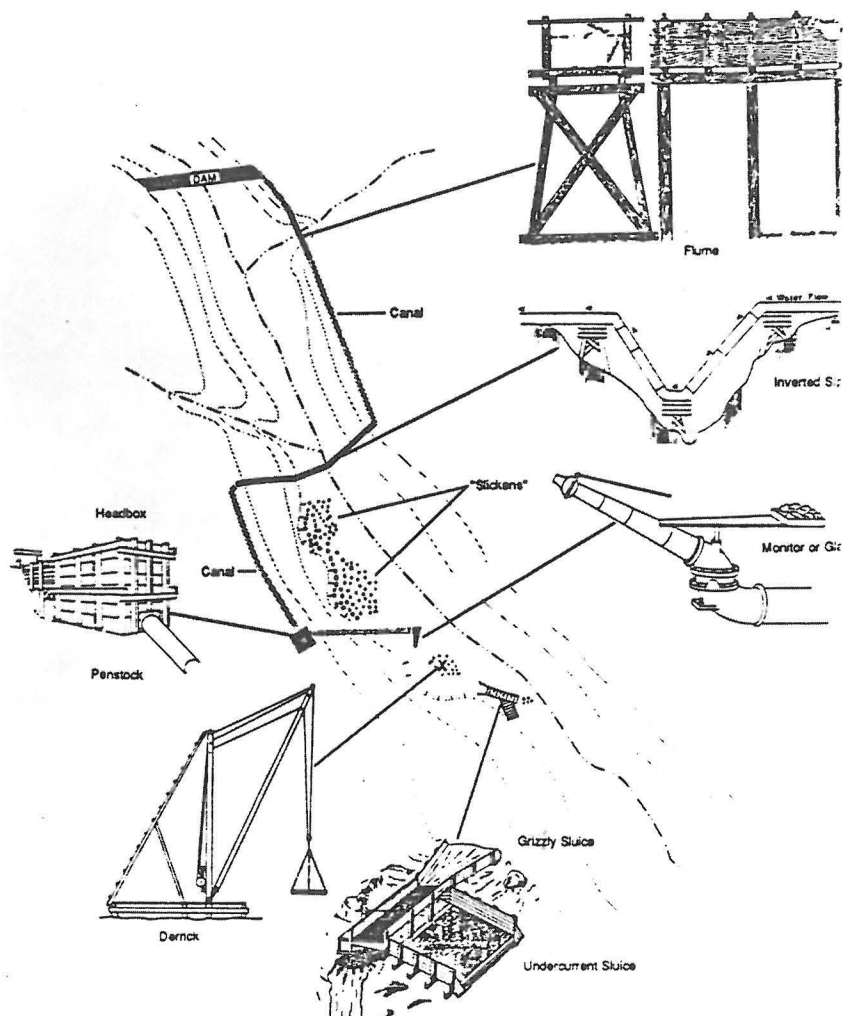
61 Report of the Governor of Arizona, 1899, p.64;

62 Wilson, E.D., *Gold Placers and Placering in Arizona*, p.15-17. Wilson also states that his pre-1900 figures are low because, "no records were kept, and, many miners took their gold with them when they left the country." He further says that for the period 1902-1950, "almost three-fourths was produced during the ten year period, 1933-42, in large part by mechanized operations in Lynx Creek, Big Bug, and Quartzite areas." However, Karl Von Mueller, in *Placer Miner's Manual*, Volume 1, p.26, Table two, says Arizona had a pre-1900 placer production of \$8,200,000 and produced another \$738,463 by 1932. At the same time, Volume 2 of the 3 volume series, in the chart on pp. 41-43, "Hydraulic Placer Mines Being operated in Western United States" does not include a single operation in Arizona.

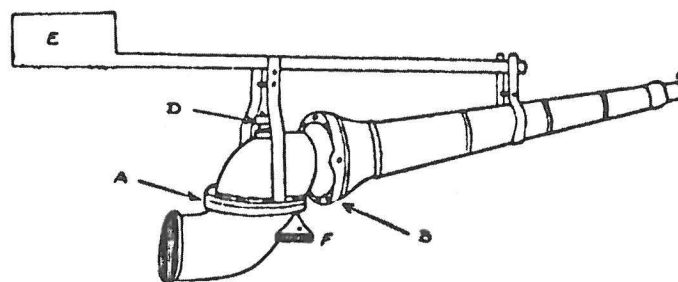
63 Ayres, *Humbug!*, figure 5, p.21.

64 WAARA Collection, folder 3, document box 315, Sharlot Hall Museum. This file contains a number of corporations, most incorporated in Missouri, for hydraulic operations in the Lynx Creek, Big Bug Creek, Hassayampa area.





Schematic Plan of Typical Hydraulic Mining System



Sketch of giant or monitor.

The figure illustrates how a giant can be moved or swiveled. It may be moved in a complete 360degree circle horizontally from point "A". From point "B" it can be moved 60 degrees, 50 degrees up and 10 degrees down. The strong upward thrust of the entering water is taken up by the king bolt, point "D". A weighted lever, point "E" controls the horizontal and vertical movements and counterbalances the weight of the giant, which is bolted to heavy timbers by the bracket, point "F". The timber should be weighted down or secured to bedrock.



Typical dam construction for hydraulic mining. Courtesy of Jim McBride Collection.



Giant monitor working at hydraulic mining operation. Courtesy of Jim McBride Collection.



Hydraulic mining on Lynx Creek, Arizona c1890. Courtesy of Jim McBride Collection.



A dam used in hydraulic mining in Arizona. Courtesy of Jim McBride Collection.

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