

Courtesy of Andrew C. Leach



Andrew Martin Leach of Brownsville, California. Taken at Woods Photographic Art Gallery, Marysville, 1878.

LUMBERING IN THE NORTHERN SIERRA NEVADA: ANDREW MARTIN LEACH OF CHALLENGE MILLS

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Lumbering in the Sierra Nevada began with John Sutter, a Swiss adventurer whose New Helvetia (New Switzerland) was the first settlement of European Americans in California's Central Valley. Because lumber and wood products were needed, Sutter's crews in 1844 were the first to cut logs in the Sierra Nevada and to whipsaw lumber from them. Ever more lumber was needed and, in the tailrace of the partially completed water-powered mill at Coloma, Sutter's partner found gold a few years later.

From then on, need for products from the forest exploded. In support of the mining, new wood-using towns, bridges, homes, wagons, flumes and sluiceways came into being. The forest fairly rang with the shouts of men, the sing of saws and the crash of falling trees. The first sawmills were powered by two men, one above and one below, manually driving the saw through the log. Water-powered mills followed shortly, soon to be succeeded by steam-driven machinery.

Output from the first mills sold right at the saw — the demand was that urgent. Later, products from mills were sold within a local area, usually a town or group of small communities. When trees were depleted in one area the mill was moved to another with uncut woods. The product was transported by plodding animals to the market which was usually only a short distance away. Because the mills served limited markets they were small, simply constructed, and semiportable in the sense that machinery was readily movable.

In the late 1860s when the gold-mining boom had passed, the market for lumber and wood products changed. Local markets and even area markets in foothill and valley communities could not absorb the output of products from the mountain mills. Large cities and

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foreign countries became the only large market available after the 1870s. Railroads now facilitated the movement of goods for much longer distances and widened the marketplace greatly.

To exploit this growing market fully, larger mills with greater capacity were necessary. Capital outlays were much greater also, and the mills more permanently constructed. The problem of moving adequate volumes of material from the mountains to railheads in the valley was a new and critical problem. The V-flume, a wooden trough constructed to use water from mountain streams for transporting logs many miles downhill, was a solution to the problem, but it was expensive to build and maintain.

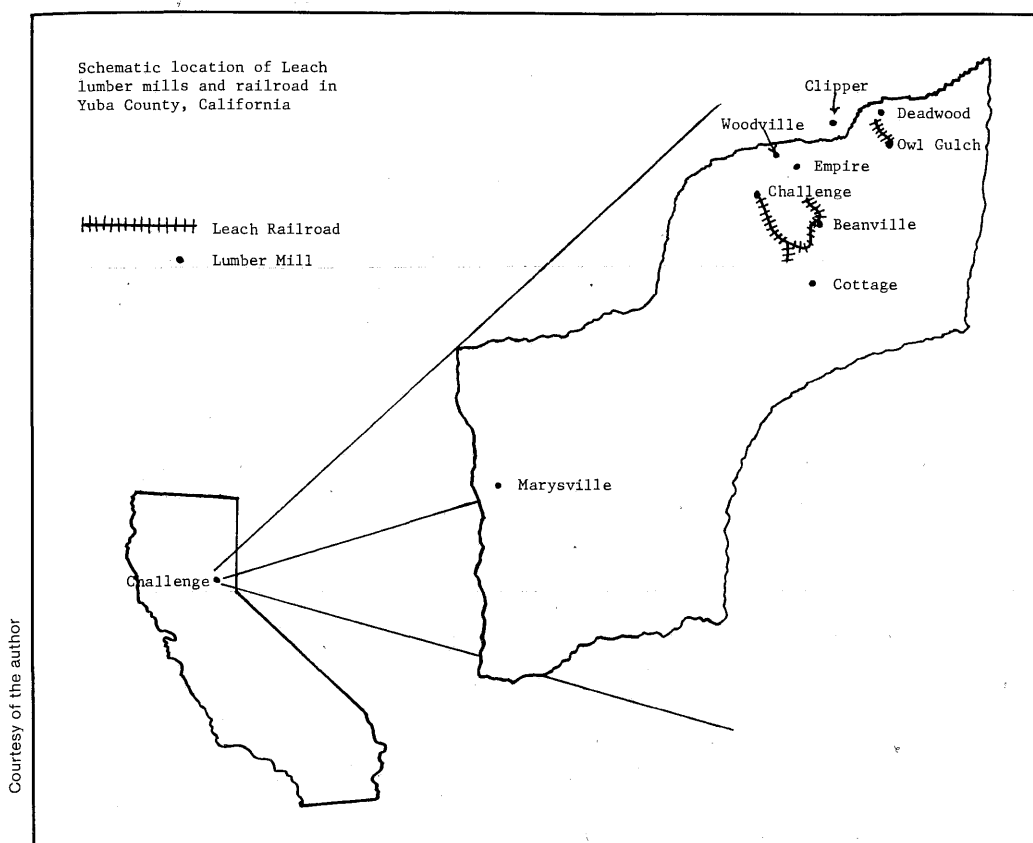
Four major companies in Butte and Tehama counties dominated the lumber industry in the northern Sierra Nevada in the 1870s. In important respects they provided the model of fluming and railroading upon which Andrew Martin Leach built his lumbering empire. The first of the four companies was the Empire Lumber Company whose forty-mile flume was begun in 1870 and completed in 1873. Internal problems and external financial difficulties caused the company to fail in 1876. The Blue Ridge Flume and Lumber Company began construction of its flume in 1872 and completed it two years later. Longer and more intricate, the flume served the company well until early 1876 when this company also went broke. The Butte Flume and Lumber Company by 1874 had built its flume down the lava-walled gorge of Big Chico Creek. This thirty-three mile flume cost \$150,000 and required two years of construction. The fourth and smallest of the pioneer lumber companies was the Sugar Pine Lumber, Flume, and Mining Company. Two years after its flume was completed, the company became insolvent in the panic of 1878.

In 1876 the remnants of the first three companies, including some sizeable debts, were combined into one company, the Sierra Flume and Lumber Company. This "true titan of the timberlands" was one of the largest and most complex lumber operations in the world.¹ With new extensions, its network of flumes spanned 156 miles. The company's large size and volume enabled it successfully to compete with lumber from the Pacific Northwest and Canada. By the fall of 1877, however, the company faced dire financial trouble, and in 1878 financial panic, drought and mill fires forced it into bankruptcy. After reorganization the smaller Sierra Lumber Company, as it was called, operated some of the flumes for many years.

The recounting of these leading events in northern Sierra Nevada lumbering serves somewhat to suggest the turbulence that seemed the constant accompaniment of the industry's growth. Andrew Martin Leach first appeared on the scene as a resident of Brownsville, Yuba County, in 1863, began to build his lumbering empire by 1873, and in negotiations that became final in 1879 he acquired five mills and acreage and cutting rights to a large amount of timberland. His career is worth particular attention and, furthermore, offers good opportunities to describe some special features of timber and lumber production in that period.

Leach was born in Pittsford, Vermont, December 7, 1841, one of three children of Martin and Harriet Leach. A paternal ancestor had come from England to Salem, Massachusetts, in 1629 as a member of the Massachusetts Bay Company. Leach apparently traveled to California once by way of Cape Horn and another time across the Isthmus of Panama. He was still quite a young man when he began to build his lumbering empire.²

The first and largest part of Leach's timber and lumber holdings was purchased from the Union Lumber Company in 1873 and 1874, in an agreement finalized in July 1879. Included in this purchase were the Deadwood, Cottage, Diamond Springs, Challenge, and Woodville mills, plus acreage and cutting rights to a large amount of timberland. Within a few years Leach owned at least 3500 acres outright.³

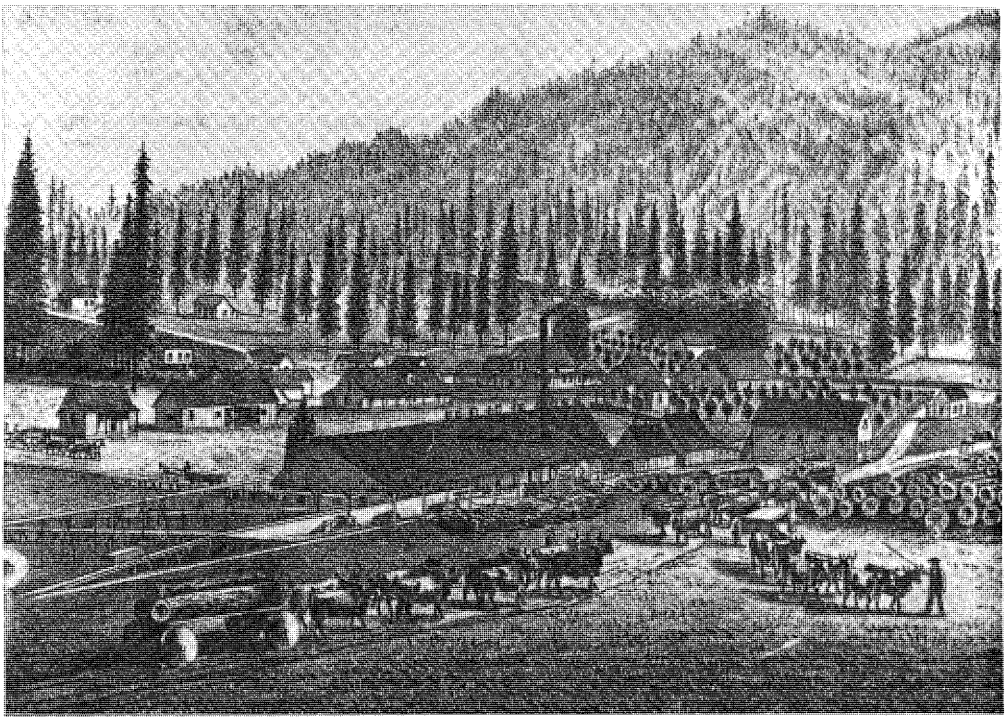


Schematic location of Leach lumber mills and railroad in Yuba County, California.

Of all the mills in Leach's empire, by far the oldest and the one that probably had the longest period of continuous operation was the Challenge Mill. It was moved to Challenge in 1858 and soon sold to Willey, Dean and Company. It was merged into the Union Lumber Company in 1864 with other mills and operated by the latter company until sold to Leach. The name "Challenge" is purported to derive from a challenge by a mill up the ridge as to which could cut the more lumber in a given day. The identity of the winner is lost in antiquity, but the name remained. For many years the hamlet that the mill served was known as Challenge Mill.

Leach's first marriage was to Margaret I. Pratt on October 15, 1878. They made their home at the center of the Challenge Mill operation and their only son, Martin Andrew, was born September 10, 1879, at Marysville.⁴ Always active in the community, Leach was a charter member and first president of the Brownsville Lodge, No. 283, I.O.O.F., initiated in 1879.

The Challenge and Leach's other mills were the mainstay of the economy on the ridge between the north fork of the Yuba and the south fork of the Feather rivers in eastern Yuba and Butte counties. Aside from a little ranching and mining, no other work was available to local people. Leach enlarged and upgraded the mills after gaining control. The Challenge Mill complex was expanded to more than twenty buildings and became the support center



1878 lithograph of the Challenge Mill and residence of Andrew M. Leach. Lithograph by C.L. Smith of Oakland, CA. Published by Thompson and West. Taken from Chamberlain and Wells, *History of Yuba County, California*.

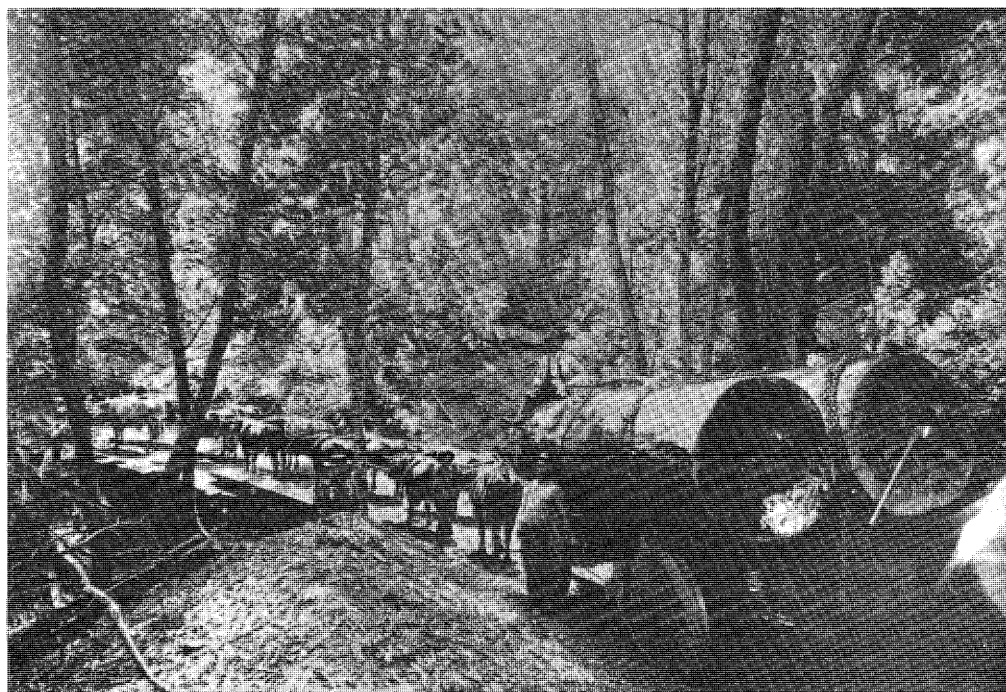
for all Leach mills. A huge warehouse, 200 to 300 feet long, contained everything imaginable for cutting, hauling and processing lumber.⁵ The blacksmith shop became as complete a machine shop as was possible for that day. Trucks (skeletal wagons) for hauling logs were one output from the shop, with axles, frames, u-bolts and wooden wheels with metal rims manufactured on the site. Leach's home occupied the center of the complex and his store was nearby. Not just employees but also residents and contractors purchased goods at the store.

The installation of new machinery made a dramatic boost in production rates of the mills. For example, around 1870 a typical mill used but one large circular saw and produced only about 4000 to 20,000 board feet daily.⁶ Soon after acquiring the Challenge Mill, Leach installed new machinery which boosted its production from 18,000 to about 40,000 board feet per day. The Challenge Mill then employed about fifty men, the Woodville Mill about sixty, and the Cottage Mill about thirty-five. Scores of other workers were employed in felling and logging the trees during the work season which ranged from six to eight months, no work being done in the winter months. A few years later, near the peak of operations in 1886, the Challenge and Woodville mills alone produced about eight million board feet annually.⁷

At some time in the 1890s Leach acquired a steam donkey engine to transport logs to the landing or loading site, but the only record of such usage was at the Beanville Mill.⁸ For the most part logs were transported by oxen, four or five yoke to a team. Sometimes the beasts were temperamental. One old-timer drove a particular ox team of Leach's for many years. After Leach went broke the team was sold and used for logging at another mill in the area.



A steam donkey engine and crew near the Beanville Mill in the early 1890s.



Oxen and log truck northwest of Challenge in 1896. Henry South (by wheel) drove an ox team like this for Leach for many years.

To get the logs properly positioned at this mill, a short but steep hill had to be climbed. One day the oxen pulled a load to the base of the hill but would not move a step further — pleading and profanity notwithstanding. Finally the old-timer was summoned. He went up one side and down the other, putting his arm around the neck of each ox and talking softly to each by name. Then he went behind the team, let out a yell, and up the hill they went.

Lifting the logs onto a movable conveyance was accomplished by cutting a “bench” in the hillside onto which a four-wheel truck would be pulled. The skidded logs were stacked above it. By means of peaveys (stout, spiked levers) and bars the smaller logs were hand-rolled onto the truck bed. Larger logs were loaded with the help of oxen, the first four members of the team being “knocked off” and used to crosshaul the logs onto the truck. Each truck usually carried a single large log. At the Empire Mill, and probably at other mills where the ground was steep, a skidway of smaller logs, generally with the bark removed, was constructed for transporting logs to flatter ground.

Independent teamsters with horse-drawn wagons hauled lumber to the valley railhead when Leach began operations, at a cost of ten to twelve dollars per thousand board feet, each trip requiring several days. If a keg of whiskey was occasionally shipped on the backhaul up the mountain, the trip often was even slower and a lot of whiskey was lost in transit.⁹ Every teamster had a gimlet, which was a little boring tool. It was easy to bore into the top of the barrel and use a small straw to obtain whiskey. Afterwards, with water substituted for the stolen liquor, axle grease plugged and concealed the hole.

It was not profitable to send low-quality lumber to the valley in wagons, irrespective of the teamsters’ thirst. Only high-quality lumber could be sent profitably in low volume, which increased the amount of wasted lumber. Following the example of his predecessors in Butte and Tehama counties, Leach began construction of a flume in 1877 or 1878. It was completed in 1879 and serviced most, if not all of his mills. The flume allowed a higher delivered volume of output and lowered the unit cost of lumber and wood products. He could then afford to ship them from the valley to the San Francisco Bay area by rail and still be competitive.

The flume was built in sections, called “boxes,” each sixteen feet long. The desired grade was one inch of fall per box or twenty-seven feet to the mile. This grade could not always be maintained and, at two places on Leach’s flume, lumber attained a speed of at least fifty miles per hour. A well-known principle of fluming is that when the grade decreases the material in the flume piles up at that point. Flume men were stationed at the base of both the Challenge and the Hansonville grades. Their job was to push the timber down the flume.

At opportune places, additional sections of flume were constructed parallel to the main flume to facilitate the loading and sorting of wood products and to catch groups of timber that could cause a jam. Untangling a bunch of heavy timbers is much easier if they are not in motion. A system of headgates regulated the amount and velocity of water at these locations.

A typical flume was twelve inches wide at the bottom, with thirty-inch sloping sides and forty-eight to sixty inches water-width. It was always lined with boards. It was constructed with all bracing outside. Side boards were mounted horizontally with additional boards attached externally at points of extreme wear, such as on the outboard edge of curves.

In spite of reinforcement, the joints of horizontal boards on the sides of the flumes, particularly around curves, were susceptible to damage from large timbers. Such damage was reduced greatly by fastening small round iron pieces on the downhill end of each board or timber. The metal devices had little points on them that were tapped into the timbers before going into the flume. These devices “smoothed the joints” and lessened the number of timber jams. One respondent’s father said, “there was one man with a four- or six-horse

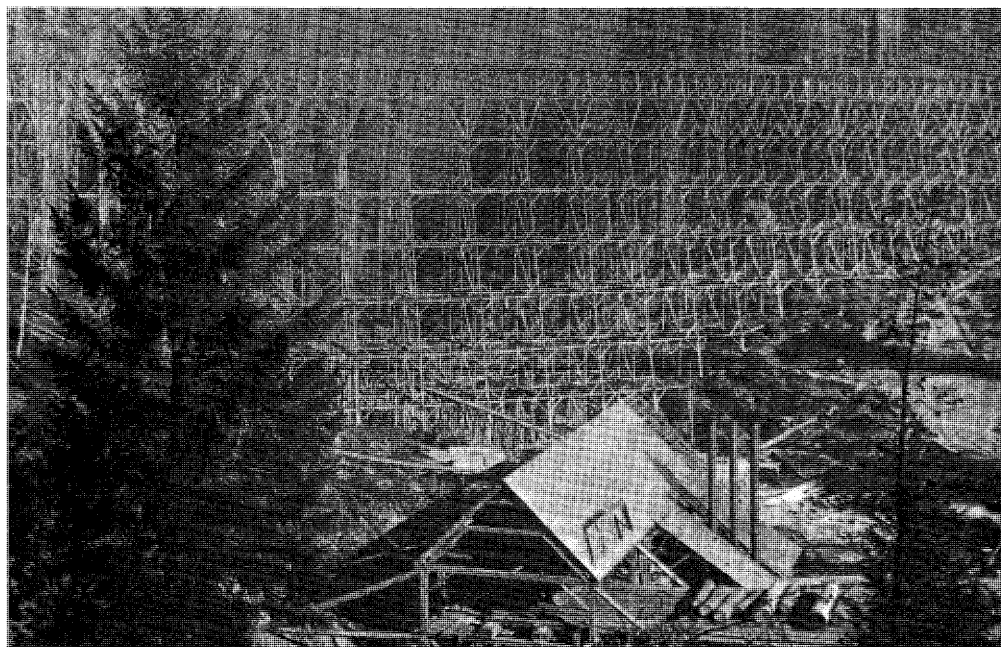
team that did nothing but haul the devices back from Moore's Station and distribute them to the various mills." ¹⁰

Leach's flume directly serviced the Empire, Deadwood, Woodville, Challenge, and Owl Gulch mills, and indirectly the Beanville operation. The flume received its initial charge of water from Slate Creek. Other creeks along its route, such as Whiskey, Jackass, Deadwood, Owl Gulch, Hampshire, Empire, Slapjack, and Beanville also provided water. Because these streams varied widely in amount of flow, and when bank-full could wipe out the flume, smaller feeder flumes, usually with headgates of some kind, were used to supply water to it. The main flume was placed in a ditch wherever possible and on trestles where necessary.

The Slate Creek canyon is deep and narrow and, to get water from it, the head of the flume had to be located well above the elevations of the mills. After leaving Slate Creek, the flume traversed the canyon of the north fork of the Yuba River, receiving water at various creeks, many of which it had to span. Owl Gulch Creek also lies in a deep canyon to cross which a trestle 166 feet high was necessary. The flume then continued into a tunnel, through hills, along hillsides, and over many lesser trestles. After it crossed the Alabama Bar Trail to the Yuba River, it contoured along the sheer face of a high granite bluff five hundred feet in length. ¹¹ In such areas the flume was anchored to iron pins laboriously drilled in the rock, and ingeniously braced by stout timbers placed against the cliff.

Between Hampshire Creek and the crest of the ridge east of Woodville the terrain was extremely rugged, and an intricate series of trestles and a tunnel were needed. Near Empire Creek a long tunnel and 116-foot-high trestle had a combined length of one-half mile. Such construction was extremely expensive.

After leaving the crest, the flume traversed much easier terrain, curved around the head of Slapjack Creek and followed along just below the stage road to the top of Challenge Hill where a short tunnel took it under the road. To this point, a distance of about twenty miles, the grade of the flume was rigidly adhered to because deviations meant many more feet of costly hillside flume. From the top of Challenge Hill, however, considerations of grade were



Owl Gulch flume and mill, 1893.

not so important — all was downhill. The Challenge grade was steep, the first of two places where flumed lumber reached a speed of at least fifty miles per hour.

After leaving the mill at Challenge, the flume continued down the draw to the east, bypassing the town. It then wound around in back of Brownsville to the top of Hansonville Hill. At this point the flume practically dived down the hill, the grade being long and extremely steep. The flume then wound through the foothills, eventually ending up at a point on the California Northern Railroad where a bustling community called Moore's Station sprang up. Leach built a planing mill near the end of the flume where forty men dressed a million board feet of lumber each year. A box factory in which Leach probably had a financial interest was also constructed nearby.

Men called flume tenders constantly patrolled the flume to look for breakouts and ensure that the material was moving along. They would usually walk the upper side of the ditch but, on trestles, a single eight-inch-wide board served as a walkway. Because some trestles were very high above ground and the narrow walkways often were slick with spray or ice, a flume tender had to have more than just a little courage. These men carried a short-handled curved pickaroon, as it was called, to reach in and hook an offending piece of lumber. Around Challenge the lumber herders were local citizens, each of whom patrolled about four miles of flume. Near one of the outlying mills, however, Chinese employees were the patrolmen.¹²

At strategic intervals along the flume, cabins containing a stove, bunks and groceries were built for emergencies. Should a jam or breakout occur, requiring extended labor, a patrolman could find sustenance and shelter there. Sometimes lumber was flumed at night. If a can full of pebbles hung from the flume kept rattling, the lumber was coming down in good fashion. If it stopped rattling, a patrol up-flume was necessary.

Written articles state the length of the Leach flume to be forty or eighty miles, and a recent report denotes it as being about fifty miles.¹³ Because of all the twists and turns, the total length of the flume is difficult to quantify. That the flume, which used about 130,000 board-feet per mile, was a major consumer of Leach's lumber during construction, and that it was extremely expensive to build, is a certainty. One author stated that the flume from Challenge to Moore's Station cost \$80,000 and "the trip of thirty miles occupies about six hours with a constant line of timber and wood floating down."¹⁴ These lower miles, of course, were relatively easy miles; the upper reaches were the expensive ones. A more realistic cost in 1876 for mountain flumes with considerable trestlework was about \$4,000 per mile.¹⁵

Not only was the flume patrolled by foot, but apparently flume "boats" were also used at certain places and in certain circumstances. The flume boat was nothing more than a V-shaped pig trough constructed of two-inch planks, with boards nailed across the top for seats. Occasionally a logger or miner in the mountains would imbibe too much tarantula juice and accept a dare to ride the flume boat to the end of the line. Because of the height of the trestles and the speeds attained, particularly on the steep grades, no inebriated logger ever emerged anything but stone, shivering sober at the end. Naturally the flume splashed into the millpond, so a flume-boat rider was assured of at least a dunking.

A wide variety of wood products went into the flume. The most common were various sizes of timbers such as 2 × 4's, 2 × 8's, etc., 16 feet long. Many timbers were 4 to 12 inches square and of various lengths, the largest being 12 × 16 inches and 32 feet long. Other products were railroad ties, posts, bundles of shakes, and four-foot lengths of stovewood. Chinese laborers cut large amounts of wood on Indian Creek and hauled it to the flume and stacked it. Because maintaining a steady flow was based mostly on experience, only Leach employees were allowed to place wood products in the flume.¹⁶ Settlers clearing land found the flume to be an asset: "All the wood that can be supplied is taken at \$2.25 per cord at

anyplace along the flume."¹⁷ In 1886 about six thousand cords were sold. Whether Leach bought these or other wood products, or whether people paid him to send their wood or posts down the flume is not known. One additional desirable product occasionally came down the flume — a lady who lived near a headgate would catch trout, up to fourteen inches long, in the flume when it was drained.

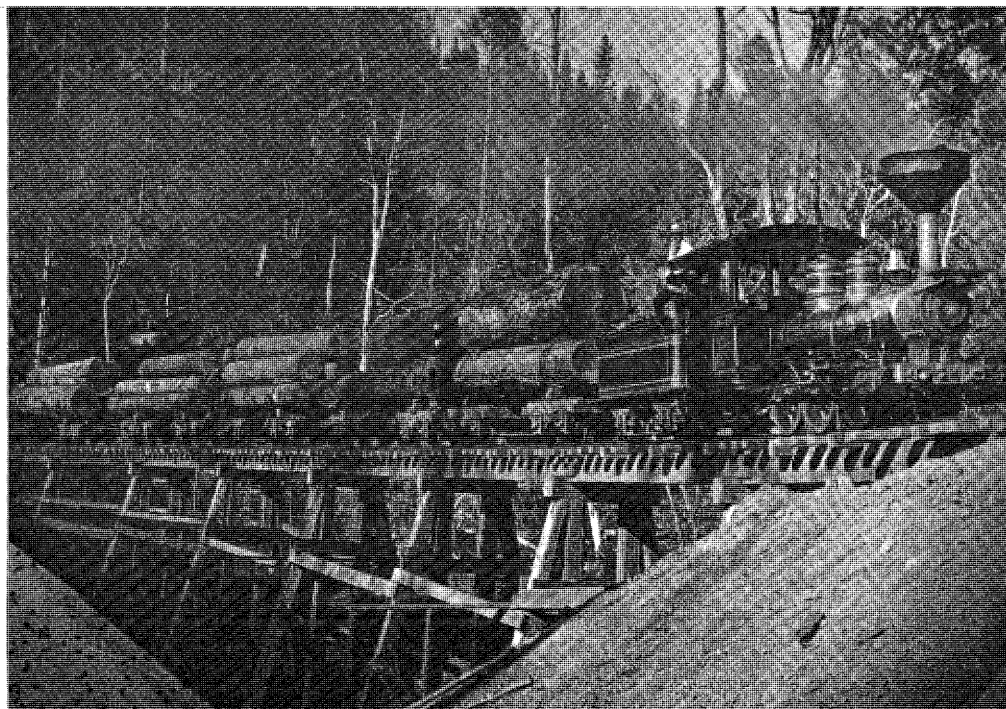
The flume was open, of course, and when shakes or timbers were floating by they were vulnerable to theft. Little of this apparently happened. Occasionally a jam and breakout would occur and wood products would spill down the hillside. Company workers rarely ever put this material back in the flume.

In the 1870s a common practice of the mills was to "run their sawdust," meaning that a small water-filled flume located directly beneath the headsaw would carry the sawdust off below the mill where a large pile often accumulated. At one mill, an enterprising fellow tunneled into the huge sawdust pile, hauled in blocks of ice, and had a ready-made refrigerator there for years.¹⁸

One product of the V-flume that was never sold was water. Evidence exists, however, that Leach was aware of the possibility of irrigating valley farmland with mountain water.¹⁹ Placing most of the flume in a ditch, for example, was no accident. Try as he might, however, Leach could not financially justify extending his flume farther into the valley purely on the basis of selling water.

By 1884, available timber close to the Challenge Mill was gone and the oxen-drawn log trucks had to travel an ever-increasing distance. Because log-hauling costs were rising, a better, faster means of getting logs to the mill was needed.

In June 1884 a Baldwin 0-6-0 locomotive with tender was ordered for delivery at Moore's Station. By 1886, the rails extended about two miles southeast of Challenge into what is now



Courtesy of Ethel Ashburn

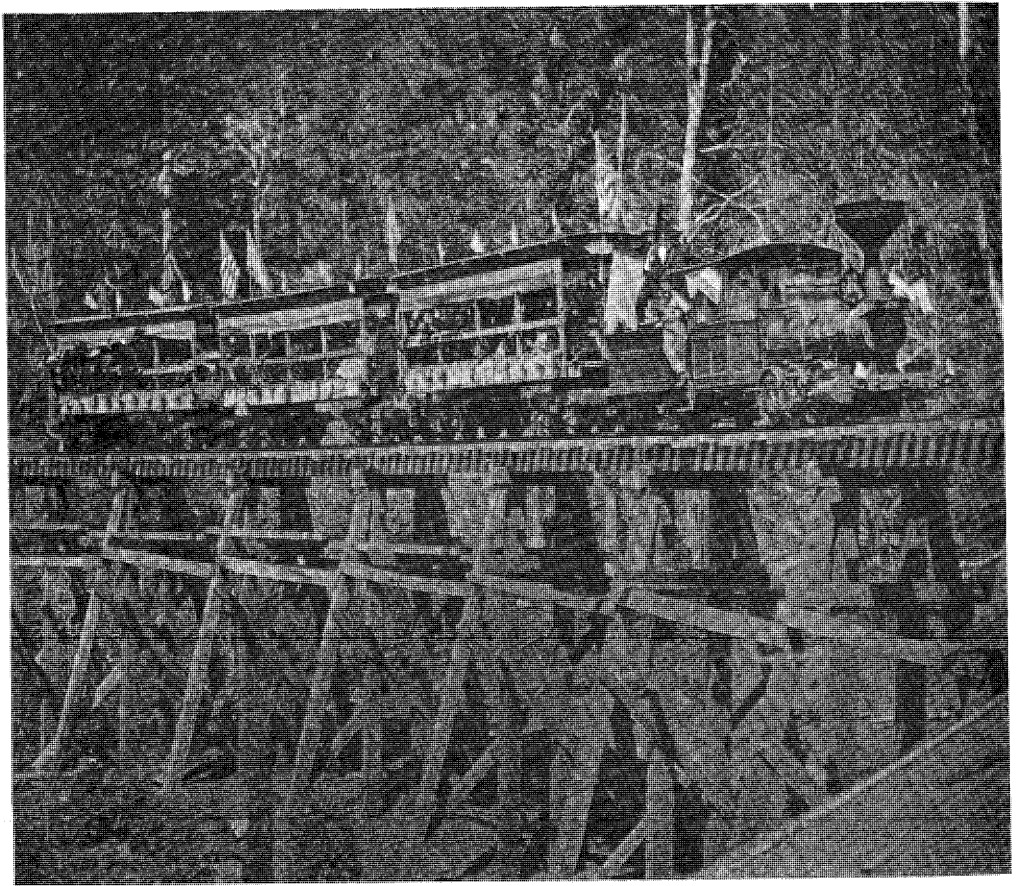
Baldwin rod engine and loaded flatcars between Challenge and Beanville about 1887.

the U.S. Forest Service's Challenge Experimental Forest, and by 1887 the rails had looped around to Beanville Creek, an additional distance of about 2 ½ miles. Two years later the railroad had advanced up Beanville Creek, crossed at a relatively level spot, and extended up Indian Creek a short distance. The Beanville-Indian Creek trackage totalled about one mile. The total length of the Challenge Mill narrow-gauge railroad at its peak was only six miles.²⁰

Leach's choice of locomotive was sound. Its relatively small diameter drive wheels and fast-steaming boiler were ideal for short hauls on relatively good track. Weighing slightly less than fifteen tons, the locomotive also struck a good balance between traction and load.

At the Challenge Mill complex and just west of what is now the Yuba-Feather Union Elementary School, "immense quantities of lumber were by the side of a balloon-shaped railroad track, one-third of a mile in length."²¹ The engine was an interesting sight and much viewed and discussed by local citizens. "It burned wood and there always was quite a lot of smoke and ashes flying out when they were traveling along."²²

Leach recognized the value of trained employees and the gain from good public relations. The fourth of July was a day of big celebration, and what better way to celebrate than with a train ride? Leach had his employees build special seats and canopies for the flatcars, and decorated the train with flags and banners.



Courtesy of Ethel Ashburn

The fourth-of-July train near Challenge in the late 1880s. Note the people crowded on the flatcars, converted and decorated for festive use.

By 1887 the Leach lumbering operations were at their peak. To be sure, the Diamond Springs Mill had burned on November 16, 1880, and the Cottage Mill had closed, but the other mills were producing well. Most important, the expensive flume probably was paid for, and maintenance, although always a large expense, was not prohibitive.

Then a series of disasters hit. On October 17, 1887, it was reported, "Leach's mill at Challenge, Yuba County, burned, completely destroying [also] about half a million feet of lumber. The loss will run into the hundred thousands. Not more than \$5000 insurance is on the entire property."²³ Some months later the planing mill, adjacent box factory, and a car loaded with box material at Moore's Station were also destroyed by fire. The lumber was saved, however, by using water from the V-flume for fire-fighting purposes. Several weeks later, the Woodville Mill was totally consumed by fire. To make matters worse, the winter of 1889 was the "big snow" — the winter of the heaviest snowfall that old-timers could remember. Snow was twelve feet deep on level ground at Woodville, twenty feet deep in places. Tunnels were dug to doors and windows for light and egress. The big snow took out whole sections of the flume, usually in the most difficult places, and of course those most expensive to repair.

The financing of Leach's empire is largely unknown. Surely he needed money and credit to purchase the mills initially, to expand them, to build the flume, and to purchase and extend the railroad. Now, with all the disasters, he needed money again — money to build another sawmill, especially, and to extend the railroad to Indian Creek. Leach wanted to construct a sawmill in Owl Gulch and to build the railroad there, also. He probably braved the financial jungles of San Francisco and borrowed heavily at this time. Deeds from the county recorders office show that Leach sold several parcels of land in 1889 and 1890, perhaps to raise money.

Leach's troubles continued; even the weather seemed to be against him. An Oroville paper commented about 1890: "This has been a disastrous season for sawmills in the mountains. The rains have kept the ground so soft that it is impossible to haul. The Challenge Mills have been idle most of the time."²⁴

Leach struggled on, always with ideas, never lacking in plans. Late in 1891 he traveled to San Francisco several times, and on one occasion made the news: "Mr. Leach offers a complaint regarding the advance in railroad freights; stating that it is impossible to ship lumber by rail and meet competition. Unless the freights are reduced he will probably extend his flume further down the Feather River so that he will be able to compete in the central market. Mr. Leach talks of forming a new company and building two mills, one of which may be commenced this fall." One of the new mills was to be at Woodville, but to cut only five thousand board feet daily. Still later in 1891, "The Leach Manufacturing Company, a new concern organized by A.M. Leach to do extensive lumber business on the upper Feather River," was created. Shortly after, Leach ordered two band mills.²⁵

But no record exists that Leach ever extended his flume or built the new mills. The band mills may never have been paid for, or perhaps they were installed in his remaining mills, the Empire and Owl Gulch. The Deadwood Mill had ceased to function in the late 1880s.

The depression of 1893 was severe. A contemporary commented: "The lumber interest in California looks black. The depression in general business has affected the entire trade and millmen are going slow. Some mills have shut down and other mills are working only part time. The only thing for lumbermen to do is wait. The present state of affairs cannot last always, and soon brighter times may be expected."²⁶

Brighter and better times did not emerge, however. Leach borrowed money from his employees and owed many of them "time"; in other words, employees were working on the premise that eventually they would receive money. Employees also were paid with scrip —



Road engine and empty log truck on the south side of the Leach residence at Challenge in 1892.

good only at Leach's store. Sometime in 1894, Levi and Greenwald of San Francisco closed the books and took over all of Leach's holdings on the ridge. Thus ended the saga of A.M. Leach, "manufacturer of, and dealer in all kinds of lumber, shingles, shakes, etc." as his trade card stated.

Leach moved to Dunsmuir, California, in 1894 and opened a small grocery store. When this failed he turned to construction and built several homes and apartments in a business that eventually proved successful. He remarried in 1896 and two children, born in Dunsmuir, resulted from this marriage. Andrew Martin Leach passed away after a series of strokes on Christmas Day, 1908.

Leach's lumbering operations were generally similar to those of his predecessors of the early 1870s, but differed in two aspects. First, Leach operated continuously from 1879 to 1894 — a span of fifteen years — much longer than most of his earlier counterparts with lumbering operations of similar size. Second, Leach always was independent and never incorporated. One joint venture was negotiated but was short-lived. Leach supervised the whole operation — coordinating land, cutting rights, eight mills, an estimated fifty miles of flume, six miles of railroad, the store, blacksmith shop, and several score of employees.

No record can be compiled of Leach's total output of lumber and related products, nor what role his mills played in the economic history of the state. If he averaged five million board feet per year for fifteen years, a rough speculation would be about seventy-five million board feet of lumber. Undoubtedly, some of this material helped San Francisco and other cities to grow and increase in prosperity.

Perhaps an equal benefit was that which accrued to the citizens of the Challenge area. Steady employment and all the meaningful things in life that go with it for the better part of

fifteen years meant a great deal. One local old-timer, when asked how people felt about Leach, said: "Leach was probably the most able promoter our section ever had, or will ever know, and at the peak of his developments had more people employed in his various enterprises than any other man in the history of northern California."²⁷

NOTES:

1. W.H. Hutchinson, *California Heritage, a History of Northern California Lumbering* (Santa Cruz: The Forest History Society, Inc., 1974).
2. F. Phelps Leach, *Lawrence Leach of Salem, Massachusetts, and Some of His Descendants* (St. Albans, Vermont: The Messenger Press, 1924).
3. George C. Mansfield, *History of Butte County, California* (Los Angeles: Historic Record Co., 1918), pp. 283-284; W.H. Chamberlain and Harry L. Wells, *History of Yuba County, California* (Oakland: Thompson and West, 1879), pp. 92-96; and letter of A.P. Willey to H.S. Wells (April 14, 1879). *Thompson and West Document*, microfilm #TW 134, Yuba County Library, Marysville, CA.
4. Martin Andrew Leach built an automobile in Los Angeles from 1919 to 1922 that was called the "Leach."
5. Ernest Kelly. Personal interview (September 19, 1975).
6. Titus Fey Cronise, *The Natural Wealth of California* (H.H. Bancroft & Co., 1868), p. 696.
7. C.E. Williams, *Yuba and Sutter Counties, California — Their Resources, Advantages, and Opportunities* (San Francisco: Bacon & Company, 1887), p. 33.
8. Alexander Moran. Personal interview (October 29, 1967).
9. Charles W. Adams. Personal interview. (October 13, 1976).
10. *Ibid.*
11. Walter Bean, "The Vee Flume." 5 pp., 1970. Copy on file at Pacific Southwest Forest and Range Experiment Station, Redding, CA.
12. *Ibid.*
13. Charles W. Adams walked the flume above Challenge and knew of key locations below. He drew the route of the entire flume on Forest Service topographical maps. Checking of aerial photos and on-the-ground verification by Forest Service Ranger District employees and other old timers, interviewed by the authors, verify Adams' location with only minor changes.
14. Williams, *Yuba and Sutter Counties*, p. 33.
15. Mansfield, *History of Butte County*, pp. 283-284.
16. Tony L. Costa. Personal interview (November 12, 1976).
17. Williams, *Yuba and Sutter Counties*, p. 33.
18. Adams, interview.
19. Bean, "Vee Flume."
20. Anonymous, "In Charles Kohler is San Rafael?," *Pacific News* (February 1974); Adams, interview; and Lizzie Foss Diary Excerpts — November 7, 1892, in *Gold Mountain Record*, Vol. 5, No. 1 (Brownsville, CA: Yuba-Feather Historical Association, January 1977), p. 9.
21. Gaylord Twogood Diary — January 12, 1878, in *Gold Mountain Record*, Vol. 7, No. 1 (Brownsville, CA: Yuba-Feather Historical Association, January 1980).
22. Moran, interview.
23. Anonymous, *Pacific Coast Wood and Iron*, 1887, 8(5):71.
24. *Daily Mercury*, Vol. XVII, No. 107 (Oroville, CA), p. 3., col. 1.
25. Anonymous, *Pacific Coast Wood and Iron*, 1891, 16(3):123, 125.
26. *Ibid.*, 20(2):70.
27. Bean, "Vee Flume."