



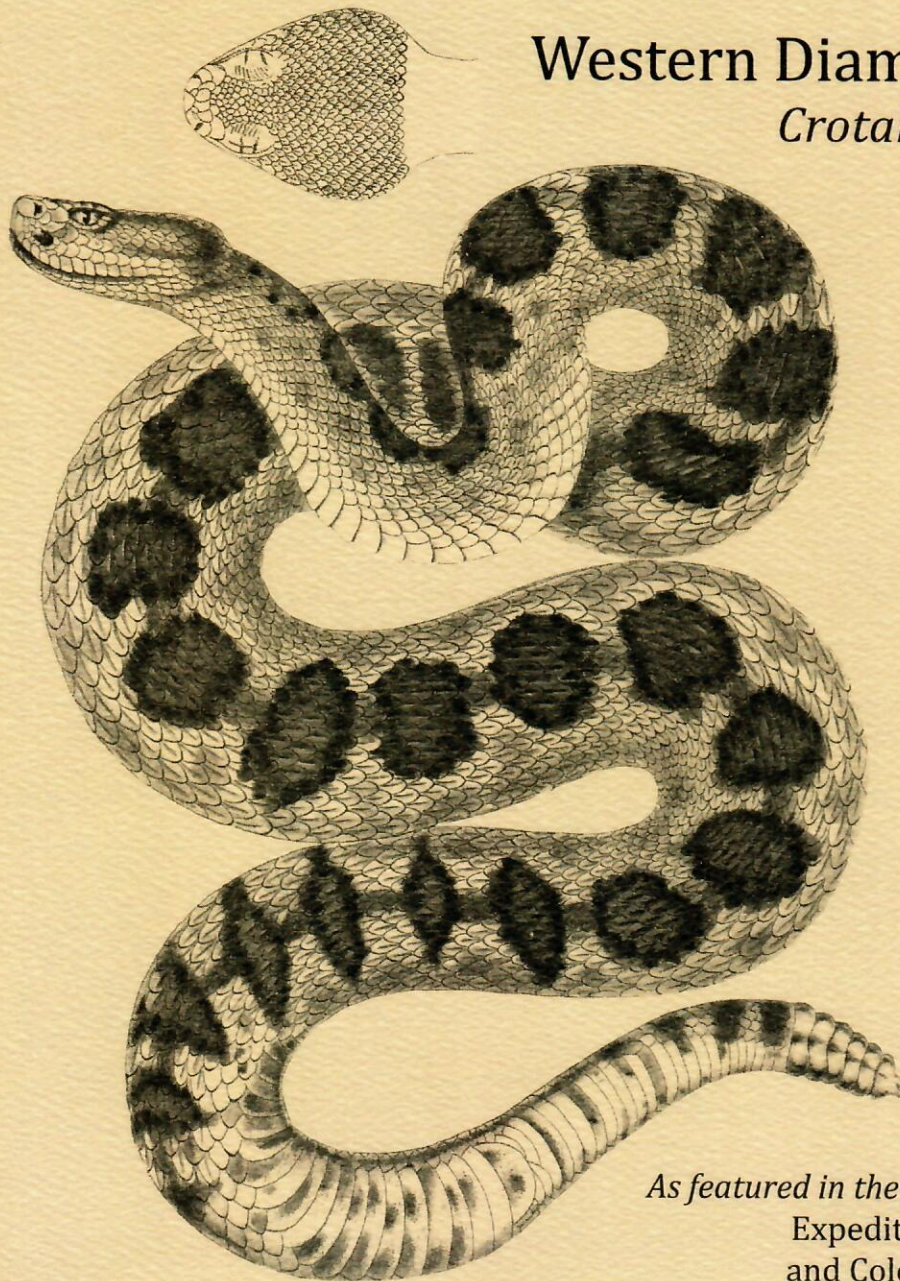
# BACKSIGHTS

Published by the  
**SURVEYORS HISTORICAL SOCIETY**

A VOICE OF THE PAST

SPRING 2018

VOLUME 37 NUMBER 1



Western Diamondback  
*Crotalus Lecontei*

*As featured in the first installment of  
Expedition down the Zuni  
and Colorado Rivers, 1853*



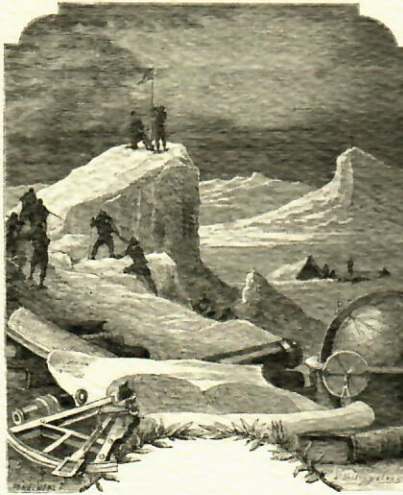


# VIGNETTES

## The Surveyor Who Devised Centigrade

Anders Celsius (1701-1744) astronomer, scientist, and surveyor, was born in Uppsala, Sweden, the son and grandson of mathematicians. He studied the aurora borealis and was the first to associate it with changes in the earth's magnetic field, and also the first to try and determine the magnitude of stars by measuring the intensity of their light by a device other than the human eye. Through these interests, it was natural that he should join the scientific expedition to Lapland led by mathematician Pierre Louis Maupertuis, to measure a meridian arc in order to ascertain the curvature of the earth. This expedition was simultaneous with Charles La Condamine's expedition to Peru, and both parties were trying to prove Isaac Newton correct in postulating that "the speed of rotation of the earth's surface increased steadily from zero at the poles to a bit over a thousand miles at the equator. Centrifugal forces increased correspondingly, and in theory, the earth should then be an oblate spheroid."

In 1736, they commenced their survey at Tornea, Lapland, carrying a chain of triangles northward to the mountain Kittis. The latitudes were determined by observations with a sector of the zenith distances to [the star] Draconis. A 14.3 km base line was measured on the frozen surface of the river Tornea about the middle of the arc; two parties measured it separately, and they differed by about 4 inches. The result of the whole was that the difference in the latitudes of the terminal stations was  $57^{\circ} 29' 06''$ , and the length of the arc 57,437.9 toises [1 toise = 6.396 U.S. feet,

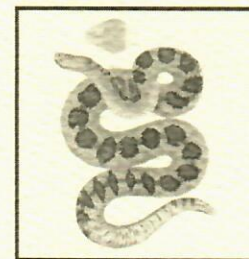


so their total distance was nearly 70 miles]. Observations were also made with a pendulum to determine the force of gravity, and these observations coincided with the geodetical results. Although the measurements were later found to contain significant errors, they were still in the right direction and were scientifically revolutionary in a number of ways. With the findings obtained on his expedition, Maupertuis and his expedition scientists were able to prove that Newton's theory was indeed correct; the Earth is flattened at the poles. The king of France awarded them with yearly pensions for the effort. Celsius published his Observations on the Measurement of

the Earth in 1738. He became a member of the academies of Stockholm and Berlin, and of the Royal Society of London, and was appointed secretary of the Royal Society of Uppsala. He died at the young age of forty-three in his hometown Uppsala.

In his Biographical Encyclopedia of Science and Technology, Isaac Asimov writes, "Celsius' greatest accomplishment, as it happened, had nothing to do with astronomy. It concerned the temperature scale he devised, which divided the temperature difference between the boiling point and the freezing point of water into an even hundred degrees. He first described this in 1742 when he placed the boiling point at  $0^{\circ}$  and the freezing point at  $100^{\circ}$ , but the next year this was reversed. This is the centigrade scale ('hundred steps') and is used by scientists everywhere. In 1948 it was decided by general agreement to refer to it as the Celsius scale." ■

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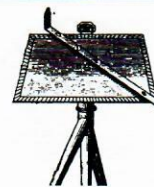


On the Cover: Plate III  
Crotalus Lecontei, from  
Hallowell's Reptiles report,  
from Vol. 10, Parts 3 & 4,  
Railroad Route from  
Mississippi River to the  
Pacific Ocean, 1853-1856.



# CHIPS FROM THE BOARD

by Richard Leu



In the Spring 2017 issue of *Backsights* I mentioned I had submitted a proposal for a hands-on 19th century surveying field exercise at the Annual Gathering of the Thoreau Society in Concord, MA each July. My proposal was accepted and, thanks to the participation of **Surveyors Historical Society (SHS) members David Ingram, Chas Langelan and Kim Buchheit**, that event came off without a hitch. However, the Thoreau Gathering uses a concurrent session format and it seems we were scheduled in the same time slot as a highly popular Thoreau scholar whose presentation was not to be missed. Thus, several people expressed disappointment that they were unable to attend our "Thoreau with Compass and Chain" demonstration. So, David Ingram and I have decided to give an encore performance at the 2018 Gathering. This year we will make it an all-day event so Gathering attendees can come and go as their schedule permits. There is considerable interest in Thoreau's surveying career but, except for Patrick Chura's excellent book *Thoreau the Land Surveyor*, it seems to have been largely ignored by Thoreau scholars.

Those who attended *Rendezvous 2017* in Concord, Massachusetts will recall that SHS, in conjunction with the National Society of Professional Surveyors (NSPS) Final Point program, set a Final Point marker Henry David Thoreau's grave in Sleepy Hollow Cemetery. SHS had been negotiating with Thoreau Farm, Henry's birthplace, to place a poster commemorating Thoreau's surveying

career somewhere in the Thoreau farmhouse. Unfortunately, that project never materialized. However, following *Rendezvous 2017* David Ingram proposed enhancing the Final Point program by adding a Point of Beginning option and his concept was approved by the NSPS Foundation Board. Consequently, if all goes according to plan, the first NSPS/SHS Point of Beginning marker will be installed at Thoreau Farm in time for a dedication ceremony on July 15, 2018 during the Thoreau Farm Picnic (part of the Thoreau Society's annual gathering). Other potential sites for Point of Beginning markers would include George Washington's birthplace in Virginia and Abraham Lincoln's birthplace in Kentucky. Where would you put a Point of Beginning marker? Let us hear from you.

The SHS bylaws call for a Board of Directors consisting of seven members. Each year, the terms of at least two Directors will expire and an election must be held to fill those expired terms. This year, we will be holding an election to fill the positions currently held by Denny DeMeyer and Steve Okuley. Denny has indicated he will run for re-election. Steve, however, will be stepping down. The policy of the Board of Directors is to have at least two candidates for each open seat. Therefore, we need three SHS members who are willing to run for a position on the Board of Directors. If you have an interest in this opportunity, contact nomination committee chair Jim Vianna for details. His contact information is on page 15.

Don't forget to register for **Rendezvous 2018 in New Orleans.** ■

## EDITOR'S PEN:

*"Plimpton 322"*



Mary M. Root

A palm-sized clay tablet from 3,700 years ago has created quite a stir among mathematical scholars, as new research suggests it may be the world's oldest trigonometric table. If true, the known history of mathematics will change greatly, since Hipparchus of Nicaea has long been credited with trigonometry's creation over 1,000 years after the little clay tablet was inscribed.

Unearthed by early 20th century looters near the ancient city of Larsa (modern Tell Senkereh), the tablet was among hundreds obtained by the flamboyant Edgar J. Banks, a diplomat, amateur archaeologist, and antiques dealer. Around 1922 Banks sold the Babylonian tablet to New York publisher George Plimpton, who in turn bequeathed his collection to Columbia University, where it now resides. Due to its collection number, the tablet is known as "Plimpton 322."

Mathematical scholars have debated the meaning and purpose of Plimpton 322 ever since. It is written in Sumerian cuneiform (wedge-shape) symbols, and has four columns and 15 rows of numerical figures. In 1945 it was noticed that Plimpton 322 contained information about right triangles, describing them in the Babylonian base 60, or sexagesimal, place value system. From that point various theories have emerged centering on the intent of the table, and what the first column of numbers is meant to represent, since the upper left corner of the tablet was broken off and does not reveal that column's purpose. One scholar holds that the mathematical table is a

teacher's aide, since Plimpton 322 presents "a repetition of the same mathematical set-up fifteen times, each with a different group of well-behaved numbers. It would have enabled a teacher to set his students repeated exercises on the same mathematical problem, and to check his intermediate and final answers without repeating the calculations himself."

In a new study (August 2017) by professors Daniel Mansfield and Norman Wildberger of the University of New South Wales in Sydney, believe that Plimpton 322 "describes the shapes of right-angle triangles using a novel kind of trigonometry based on ratios, not angles and circles." The professors contend the numbers represent a special pattern called Pythagorean triples, of which the most well-known example is the 3-4-5 triangle. On Plimpton 322, Mansfield and Wildberger believe the second and third columns list the smallest and largest member of each Pythagorean triple expressed in ratios, with the mysterious 1st column representing "the square of either the hypotenuse or the shortest side of the triangle divided by the square of the longer side." Interestingly, there are potential modern applications because the base 60 calculations permit more accuracy than modern base 10 fractions. Also, if the professors are correct, they will have opened the door to understanding how the Babylonians constructed complicated architectural and engineering works, and a "working tool which could have been used for surveying." ■





# California-Nevada Boundary Dispute

by Mary M. Root, LS



In July, 1976, Francois (Bud) Uzes, on a busman's holiday, retraced the California-Nevada boundary north of Lake Tahoe by following old survey markers with the help of original maps and notes. Uzes, a veteran surveyor who heads the boundary section of the State Lands Commission, found during his investigation that "there were significant differences between the old surveys." The original surveyors made some serious miscalculations, mostly attributable to inadequate time-telling techniques or faulty instrumentation, Uzes concluded. If the problem involved only wasteland, it would probably have been susceptible to amicable resolution in a quiet title suit. But the area of discrepancy includes the north shore of Lake Tahoe and four casinos built on the assumption that they were in Nevada. Uzes' calculations indicate they are not. So California and Nevada have taken the boundary dispute to the U. S. Supreme Court.

California, the moving part of the suit, asked the court to declare a line surveyed by Col. Alexey Von Schmidt in 1872-73 as the true boundary between the states. That boundary, Uzes points out, is "based on 105 years of actual acquiescence" by the two states, acquiescence that is formalized by a conspicuous border marker at Stateline on the north shore of Lake Tahoe. But the Von Schmidt line extends nearly a third of a mile into Nevada at the lake and takes in four casinos, which is not acceptable to Nevada.

Nevada asserts that the proper boundary is one surveyed in 1863 by J. F. Houghton and Butler Ives. It has been recognized by statutes in both states as the true boundary, although, as Uzes points out "it has no actual usage. Few know where it is." The Houghton-Ives line runs into California approximately 3,000 feet west of the Von Schmidt line.

In his book "Chaining the Land," Uzes asserts "there is a need for immediate action to resolve the problems created by the old surveys not following precisely the Congressionally approved boundaries."—*Eric Brazil, Gannett News Service, 1978*

## The Houghton-Ives Survey of 1863

Early attempts at locating California's eastern boundary resulted in only locating the endpoints at Lake Tahoe (formerly known as Lake Bigler) and at the Colorado River. The actual location of the state boundary between these points remained uncertain, so California and Nevada commissioned a joint survey of their border conducted by California Surveyor General J. F. Houghton, Nevada Commissioner Butler Ives, Chief Engineer John F. Kidder, Transit Man James S. Lawson, and Topographer and Barometrician M. G. King.

From Kidder's report to Houghton: "On May 22 I reported to you at Lake Bigler as in readiness to commence observations necessary to verify the initial point as established by Lt. J. C. Ives. For the purpose of making said observations, a large altitude and azimuth instrument [Parkinson & Frodsham of London, 12-inch horizontal circle reading to 10 seconds, and a 16-inch vertical circle reading to 5 seconds, telescope 4 feet in length] had been provided, and the full notes of Lt. Ives' observations. Observations by myself, and the latitude computed, which differed only in seconds, and Lt. Ives' results were used in the survey as correct."

Kidder telegraphed for a fix on longitude, and the answer resulted in "a longitude 119° 58' 15" west from Greenwich, or 0° 01' 45" east of the 120th meridian." Houghton wrote, "The geographical position of the initial point thus determined, it became necessary to calculate the azimuth of a transit line or arc of a great circle connecting the two points." Houghton asked Professor J. E. Hilgard, in charge of the

United States Coast Survey Office in Washington, to compute "the azimuths of the line at every degree of latitude, also the distance on the line between parallels" and received "a very satisfactory computation." His report continued, "It was readily apparent that the initial point, at the intersection of the thirty-ninth degree of north latitude with the 120th meridian, fell within the lake about three and two-thirds miles from the southern shore. It being impossible to set an instrument at the initial point, and the azimuth of the line being changeable with every advance, it became necessary to find another point upon the line upon which to establish our observatory, and set our latitude and azimuth instrument for establishing by observation the true meridian, and from which to compute the new azimuth and turn off the angle of the line." They made nightly observations for two weeks. On June 6th, "the line was fairly commenced from Lake Bigler north" carrying it across hills and valleys until they had reached Long Valley on June 19th. There Mr. King, with two others, quit the party "owing to fear of Indians." Nonetheless, the survey was continued on, reaching Smoke Creek on July 11th; the line north was complete and they returned to Lake Bigler. The survey of the 400+ mile line south was halted in October 1863 after only covering 103 miles due to "Indian troubles and winter weather setting in." In 1866 another 73 miles was run by James Lawson and William McBride, but that was the last joint effort made by California and Nevada.

## Daniel G. Major's Survey

Both California and Nevada adopted the Houghton-Ives line by statute, but its significance was to be short-lived. In 1867-1868, Daniel G. Major surveyed the Oregon-California boundary for the General Land Office. One step in his work was to locate the intersection of that boundary and the 120th meridian. Without making any reference to the Houghton-Ives survey, and without leaving any clear indications of how he computed his location, Major established the northeast corner of California more than two miles west of that meridian as marked by Houghton-Ives. Furthermore, Bud Uzes reported, "When Major traced the 42nd parallel, he took astronomical readings with a sextant only three times. As a result, he wavered back and forth across the true line as he made his way west from the 120th meridian to the Pacific Ocean." Disparities in the line led officials to recommend a new survey.

## Alexey W. Von Schmidt Line 1872 - 1873

The new survey was conducted by Alexey W. Von Schmidt. While originally instructed to commence his north-south line at the point located by Daniel G. Major, Von Schmidt concluded that the actual 120th meridian lay not only east of "Major's corner," but six-tenths of a mile east of the Houghton-Ives line as well. Accordingly, Von Schmidt marked a new north-south line starting at this location. His survey of the oblique boundary also had its surprises. From the intersection of his north-south segment and the 39th parallel, he set off in what he thought was the direction of the intersection of the Colorado River and the 35th parallel. Unfortunately, the Colorado River had shifted since the point for which he was aiming had been marked, and rather than end at the wrong place, he attempted to correct the line he was marking. It later turned out that his corrections were not complete, and his line not entirely straight. In an article on California boundaries (Foresight newsletter, CSU-Fresno, Fall 1988), Bob McGovern wrote, "Lack of calculations and physical evidence of work supposedly done became somewhat of a trademark of



Von Schmidt's surveys." But linear or not, Von Schmidt's work did generate a boundary. And, although neither State adopted it by statute, the Von Schmidt survey won gradual acceptance in both California and Nevada.

In the 1880's, however, substantial doubts about the accuracy of the oblique segment of the Von Schmidt line were voiced in Washington. As a result, Congress appropriated funds in 1892 for a new survey of that segment.

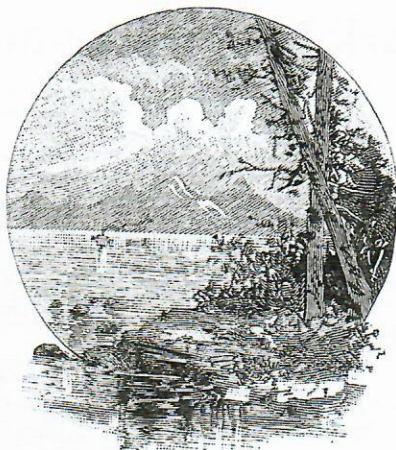
#### United States Coast and Geodetic Survey 1893 - 1899

C. H. Sinclair and W. B. Fairfield were appointed to conduct this survey, and it was limited to the portion of the state line between Lake Tahoe and the Colorado River. According to Bob McGovern, "In the first year, all that was accomplished was the astronomic determination of the endpoints. No previous work was relied upon. With the endpoints of the oblique line accurately established, the next task was to determine the azimuth of the line and begin the actual survey. The line was ranged out carefully so that all points forward and back were visible and exactly 180 degrees apart." Distances along the line and geodetic positions of the monuments set were determined from a triangulation net which proceeded along simultaneously with the survey. They used heliotropes to communicate between positions. It took several seasons and rounds of funding for them to complete the line. McGovern wrote, "After covering a distance of over 400 miles, and passing over altitudes which varied from 500 feet to 13,000 feet, Sinclair and his party closed within 150.5 meters of the point they had set six years before, an outstanding effort for the times." It yielded a new oblique line and determined that the one charted by Von Schmidt had been neither straight nor accurate.

In 1977, when the State of California filed suit against Nevada, Bud Uzes, as Senior Boundary Determination Officer of the California State Lands Commission, formally requested help from the National Geodetic Survey. In his letter to Director Allen Powell, Uzes wrote, "You are of course aware of the California-Nevada border dispute, which is the subject of an action in the U.S. Supreme Court. Recently the validity of the oblique boundary as surveyed by the U.S.C. & G.S. in 1893-99 was challenged, and is now part of the lawsuit. For the purpose of verifying the reported position of the 120th meridian as set forth in the Sinclair report (1900), it appears necessary to redetermine positions of astronomic latitude and longitude for two stations at Lake Tahoe, one at the North Shore and one at the South shore."

#### NGS 1978 Determination of Astronomic Positions

Under NGS Party Chief R. Maxey, and using a Wild T-4 Universal Theodolite, radio time signals from Fort Collins, and Fricke and Kopff's Fourth Fundamental Catalog of stellar positions, his crew checked three monuments: California-Nevada Iron Monument 1897, Von Schmidt's Iron Monument 1893, and California-Nevada Boundary Monument No. 2 1894. The ensuing report furnished astronomic positions along with this statement: "Differences between the 1893 and the 1978 observations could be caused by procedural changes. These would include the following: (1) astronomic positions observed in 1893 were not reduced to a mean pole, (2) the star catalogs used were in a slightly different coordinate system, and (3) observation methods, reduction procedures, and instrumentation techniques were different. A detailed analysis of these differences is not part of this study. We feel that agreement, commensurate with the known differences in techniques, has been obtained between the 1893 and the 1978 astronomic positions."



LAKE TAHOE.

#### U. S. Supreme Court, and Findings of the Special Master, 447 U.S. 125, 1980

The Special Master concluded that the Von Schmidt survey of the north-south line and the United States Coast and Geodetic Survey one of the oblique line were the most recent and accurate surveys available. While noting that Von Schmidt had not been entirely accurate, the Master found that the north-south line that resulted from his survey had been consistently and routinely recognized and accepted by agencies and departments of the State of Nevada for more than a century. That the Houghton-Ives line was the first north-south boundary marked, and the only one approved by statute was, he found, beside the point, because, as a practical matter, that boundary had been superseded a decade after it was established, and neither State had objected. As for the oblique

boundary, the Master found that the United States Coast and Geodetic Survey line had not only been adopted by statute, but also been accepted and used by the two States for nearly 80 years. Since both States had treated these lines as the boundary from the time they were drawn, the Master invoked the doctrine of acquiescence to determine that together they in fact constitute the true and correct interstate boundary.

The State of Nevada's primary contention is that the Special Master's reliance upon the doctrine of acquiescence was in error. Basically, the argument is that, once Nevada and California had conducted the 1863 joint survey which produced the Houghton-Ives line, the Federal Government had no constitutional authority to mark a different line which had the effect of removing territory from one State and granting it to the other. Since the Congress was without power to determine the Von Schmidt and United States Coast and Geodetic Survey lines, the argument continues, they are without legal effect. And because States may not confer upon the Federal Government a power which the Constitution does not vest in it, acquiescence in those lines cannot make them lawful. Thus, Nevada concludes, either (1) Congress is constitutionally empowered to redraw the boundaries of the several States, in which case the Von Schmidt and Geodetic Survey lines may be upheld regardless of acquiescence, or (2) Congress is constitutionally powerless to alter those boundaries, in which case no mere century of acquiescence can convert an usurpation into law.

The flaw in this argument is that it assumes that there must be a particular relationship between the origins of a boundary and the legal consequences of acquiescence in that boundary. In fact, however, no such relationship need exist. Longstanding acquiescence by California and Nevada can give the Von Schmidt and Geodetic Survey lines the force of law whether or not federal authorities had the power to draw them. And the determination that the two States' conduct has had precisely this effect, therefore, does not place any sort of constitutional imprimatur upon the federal actions involved. See *Ohio v. Kentucky*; *Indiana v. Kentucky*. Accordingly, we need not address the issue of federal power to which Nevada adverts. It is enough that California claims and has always claimed all territory up to a specifically described boundary -- the 120th meridian and the oblique line with which it connects -- and that both States have long acquiesced in particular lines marking that boundary. If Nevada felt that those lines were inaccurate and operated to deprive it of territory lawfully within its jurisdiction, the time to object was when the surveys were conducted, not a century later. See *Ohio v. Kentucky, supra*. In consequence, we hold that, in these circumstances, the Special Master was fully justified in invoking the doctrine of acquiescence. ■





## Mark Matteson, Ames Instrument Co. by Chas Langelon, PLS

### Ames Instrument Company, Canajoharie, NY.

Mark Matteson held many different jobs in his life—even driving trucks around New York for some years—but his original training, to which he always returned, was machining.

An unassuming individual who never sought publicity, Matteson left behind almost no record of himself or his career—except for the remarkable replicas of historic survey compasses he painstakingly made alone in his barn, one at a time, for 30 years, using vintage tooling from a shuttered factory and his skills as a master machinist. Before Matteson was ever a maker of survey instruments he crafted Kentucky Long Rifles—by hand from scratch, not kits—using the laborious early techniques of 1700s American arms-makers. His replica flintlocks, which he sold for \$3500 as reproductions, were so stunningly authentic in every detail that before long they began showing up in auction listings as original antiques, complete with falsified provenance, at prestigious sellers like Sotheby's. His many alerts to auction officials that they were actually modern copies made by him fell on deaf ears, and those rifles often brought \$60,000.

To prevent such fraud, Matteson quit rifles and turned to historic antique survey compasses. He bought Gurley's old factory equipment from Troy NY, where fine survey instruments had been produced since 1845, and set it up in his barn (making his own 'dividing engine.') A nearby shed held his woodworking shop. Although never a surveyor, Mark Matteson went into business crafting reproduction early survey compasses, starting tiny Ames Instrument Company sometime in the 1970s or '80s. He was its sole employee—founder, proprietor, president, receptionist, bookkeeper, salesman, janitor—and most importantly, instrument maker.

In those days before the internet and eBay, original antique survey compasses were both hard to find and costly. Not only that, they usually needed parts or repairs. Matteson hoped a market might exist for less-expensive reproductions, in perfect brand-new condition, that actually worked. And such a market did exist—reenactors.

His first modest products, offered mostly to learn demand, were a small replica Sundial Compass and a Signalman's Compass. Both sold surprisingly well. After those came a faithful duplicate of the compass used by Lewis & Clark on their famed expedition. Modeled exactly upon a surviving original at the Smithsonian, it was an instant hit and quickly sold more than 1000 copies. Matteson's new business seemed bound for success. But then one day an official letter arrived from the Smithsonian's lawyers—Cease and Desist. No replicas were allowed to be made by anyone, of their compass, without permission. And of course, such approval was impossible to get. Unable financially to battle the Smithsonian in court, Mark Matteson reluctantly dropped the most popular and best-selling product he'd ever have.



*Above, a replica David Rittenhouse compass from Ames Instrument Company; below, Matteson's "student compass."*



Steered by requests from customers, he then turned to the iconic W. & L. E. Gurley Compass—that sturdy reliable workhorse of 1800s American land surveyors. His personal friend Milton Denny loaned him a real Gurley to copy. Just like the original factory itself, Matteson offered his replica Gurleys in several different models—plain, vernier, and even half-size miniatures. Properly fitted cases, tripods and Jacob's staffs were turned out in his woodshop. And if anyone needed reproduction survey chains, he gave them Milt Denny's number. Except for period garb, it was almost 'one stop shopping' for survey reenactors.

Milton Denny soon became his business partner, and when websites made their debut he helped Mark Matteson develop a nice one—even paying some of its cost to assist his friend.

Next from Ames' came the truly beautiful 1700s David Rittenhouse Compass, replicating one of the rarest and most highly-sought of all American survey antiques. David Rittenhouse was an unsurpassed astronomer, surveyor, mathematician and instrument-maker of colonial



Philadelphia, who hand-crafted not only superb compasses but also world-class astronomical instruments. Ames' reproduction Rittenhouse compasses incorporated all the features most commonly found on originals, such as the exquisitely engraved eight-point compass rose that was a David Rittenhouse hallmark. This elegant new offering quickly gained success, becoming Matteson's second most popular item after his discontinued Lewis & Clark. Production figures for Ames Instrument Company are gone, but based on examples known to exist a significant number of Rittenhouse reproductions were sold.

Today the rarest of all Ames compasses is the final replica model that Mark Matteson ever attempted—Goldsmith Chandlee of Winchester Virginia. The Chandlees were a family of notable clock-makers from Maryland, who moved to Winchester in 1785 and went into the 'scientific instrument' business. Their old shop still stands. Goldsmith Chandlee's compasses were dazzling displays of skilled workmanship, elaborate engraving, and expensive features like 'out-keepers,' level vials, and 'L-T Tables.' Those last were the family's own innovation. And Chandlee compass dials always immortalized the buyer along with the maker.

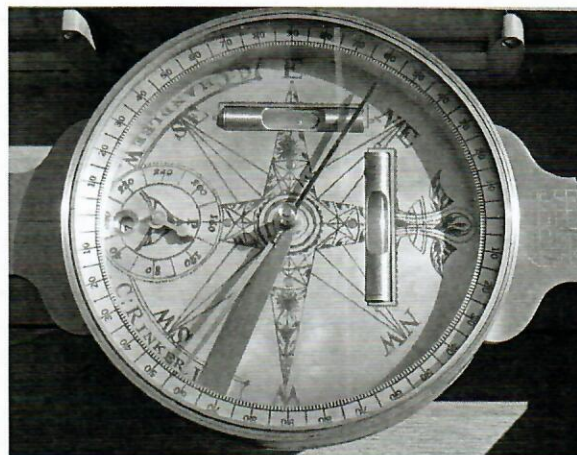
One day, fairly late in his replica-making career, Mark Matteson received a special request to craft a Goldsmith Chandlee compass as a surprise gift for a noted land surveyor of Winchester, Virginia. Although he'd never made one before, he was happy to comply, and from that point on he offered Chandlees as a new model in his sales inventory. They incorporate every feature found on the most advanced genuine originals. But alas, few Chandlee replicas were destined to be made. Matteson's health soon began to fail, forcing him to curtail his one-man production line. Thus today, not only real Goldsmith Chandlees are scarce; the replicas are too. There might be 50 original Chandlees—but fewer than six by Ames.

In the 21st century, eBay and the internet brought prices of antiques down so low that good vintage compasses could often be found for less money than it cost to build a replica. Reenactors everywhere began switching to authentic period pieces instead of reproductions. Ames' orders dropped, but in poor health, Matteson couldn't even meet the lesser demand.

Today, little is known about Mark Matteson or his Ames Instrument Company. We have more records on original makers from the 1700s and 1800s than this quiet craftsman of our own time. He was born May 16, 1938 and died at age 75 on November 10, 2013. It's unclear when he founded Ames Instrument Company and began producing his first models—but he made compasses at his barn, 12-hours a day, in summer heat and New York win-



*Replica Goldsmith Chandlee compass by Mark Matteson*



ters, for roughly 30 years. Congestive heart failure finally overtook Mark Matteson in 2012, forcing his 'factory' to close. By late 2013 he was gone. Shortly thereafter his widow sold all his shop equipment, machine tools, completed ready-to-go compasses, spare parts and remaining stock for scrap. Not even his obituary, if one was ever written, has been found.

It was characteristic of the man not to name his business for himself. Ames was the tiny New York village where his house and barn were located, a place so small it lost its post office. And now the little one-man Ames Instrument Company is gone as well. But all over America people still own and appreciate those compasses. They're the legacy Mark Matteson left behind. ■





# EYE TO EYE

Events, Notes & News

## NATIONAL EVENT

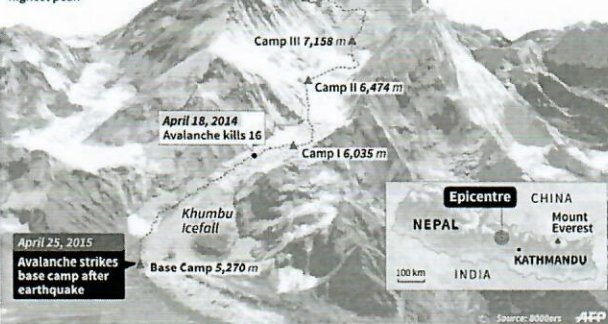
**Sept. 12 – 14, 2018. The Surveyors Historical Society, Ralph Gipson, and the Louisiana Society of Professional Land Surveyors present “Surveyors Rendezvous 2018: “Saints, Sinners & Surveyors”** in New Orleans, LA. Learn about early land surveys, mapping and engineering, with a special presentation on Bilby Towers. Classroom sessions, a field trip, museum trips, and more. Continuing education credits. For more information, call SHS Administrator Melinda Gilpin at (614) 798-5257 or email [info@surveyorshistoricalsociety.com](mailto:info@surveyorshistoricalsociety.com)

## NOTES AND NEW

- SHS members who attended the **2017 SHS Rendezvous in Massachusetts** had the opportunity to examine the Concord Library's fine collection of plats surveyed and drawn by **Henry David Thoreau (1817-1862)**. Two months later, Skinner, the Boston auction house, sold three Henry David Thoreau plats for a total of \$55,350. The three sold were described: Plan of a Woodlot in Lincoln and Concord Mass., Conveyed by Willard T. Farrar to Geo. Heywood, April 30, 1857. Signed survey in Thoreau's hand in brown ink on heavy wove paper, marking out a 3 acre 59 rod piece of land on the Lincoln-Concord town line, bound by the road to Wayland, and the properties of C. Stow, Garvis, Heywood, and Farrar; dusty, old central fold (beginning to separate), some spotting, docketed on verso with title in Thoreau's hand, 15-1/2 x 10 inches (Estimate \$3,000-5,000; sold for \$15,990); Plan of Robert D. Gilson's Mill in Littleton, Mass., May 9, 1857. Signed survey in Thoreau's hand in red and brown ink on heavy wove paper, with the notation, "The red lines showing the site of the Saw-mill, the old flume of the Grist-mill, and the former well by the curb," signed by Thoreau, the plan with sketches of stone walls, the buildings, dam, flume, and curb wheel; 22 x 11-3/4 inches (Estimate \$4,000-6,000; sold for \$11,070); and, Plan of that Part of Thomas Brooks' Woodlot, in Lincoln, Mass, which was burned over in the fall of 1857, June 5, 1858. Very large signed survey in Thoreau's hand in brown ink, finished in watercolors, mainly two tones of green, with the "place where the fire was set" painted in red, with neighbors noted: George B. Rice, John Nelson, Abel Wheeler, Albert Brooks, with paths and other features noted, including the path to the house, fences, ditches, meadows, stone walls, and cultivated land; heavy wove paper, formerly rolled, 22 x 15 inches [Together with] a small ink sketch for the same plan, covering a larger area, with different notations, i.e.: small growth of maples, still standing; brush, brakes, briers, grass, &c. unmown; space cleared to prevent the spreading of the fire this way; smooth mowing; tract of fire; and other notes; 10-1/4 x 8-1/2 inches (Estimate for both \$5,000-7,000; sold for \$28,290).
- The **Washington Map Society** supports and promotes map collecting, cartography, and the study of cartographic history. In addition to its publications, contacts with other map collectors, map dealers, and map professionals, tours of public and private map collections (Library of Congress, Geography and Map Division and the National Archives, Cartographic and Architectural Branch), members enjoy full access to their website, which includes videos of their programs. One such program occurred last October, when **Lorna Hainesworth**, listed in the Map Society's literature as "**an ambassador for the Surveyors Historical Society and an independent scholar studying American history,**" gave a talk on "Meriwether Lewis's 1806 Survey at Cumberland Gap." Lorna's talk described the anomalies in the dividing line between Virginia, North Carolina, Kentucky and Tennessee, the major contributors to the line's survey, and the controversy arising from the line's placement. SHS members Chas Langelan, Ray Root and Mary Root attended and reported that Lorna's presentation, supported by maps and diagrams was very interesting and well-received.
- In September 2017 the government of Nepal announced that it will conduct a **new measurement of Mt. Everest's height**. Nepalese Survey Department Deputy General Neeraj Manandhar pointed to seismic activity in the region, particularly the 7.8-magnitude earthquake that struck the region in April 2015. The quake caused havoc to Everest, creating massive avalanches and other issues that left 18 climbers dead at Everest's base camp. Dubbed a "national pride" project, Nepal has allocated roughly \$2.4 million to complete that project that it hopes to begin Summer 2018, depending on the weather. The task will require access to tools Nepal currently doesn't have, such as Global Positioning Systems, leveling and gravitational measuring equipment. "We are now developing a methodology for the measurement which will be discussed with international experts, and their advice will be incorporated to make sure that our work meets global standards and is internationally accepted," Survey Department Director General Ganesh Prasad Bhatta said. It is unclear whether the new measurement would displace any of the older ones, including the current official height that came courtesy of a 1954 Indian mission. This survey established the mountain stood 8,848 meters tall, or 29,028.87 feet. ■

### Mount Everest

This latest disaster comes a year after an avalanche killed 16 guides in what was then the deadliest disaster to hit the world's highest peak





# BULLETIN BOARD

Announcements, Etc.

## INSTRUMENT SERIAL NUMBER/DATE LISTS:

For makers Beckmann, Berger, Buff, Draper, Fauth, Heller & Brightly, Lietz, Young:  
[www.surveyhistory.org](http://www.surveyhistory.org)

For makers Bausch & Lomb, Gurley, Kern, Watts, White:  
[http://www.surveyhistory.org/how\\_old\\_is\\_my\\_instrument.htm](http://www.surveyhistory.org/how_old_is_my_instrument.htm)

For maker Wild Heerbrugg:  
<http://www.wild-heerbrugg.com/howold.htm>

For K & E instruments use this chart:

### K&E Serial Number List:

Number - Year	Number - Year	Number - Year
300 - 1885	32000 - 1916	95157 - 1947
375 - 1886	34000 - 1917	100673 - 1948
450 - 1887	35500 - 1918	106129 - 1949
600 - 1888	38000 - 1919	109345 - 1950
900 - 1889	41000 - 1920	111643 - 1951
1300 - 1890	42500 - 1921	115855 - 1952
1600 - 1891	44000 - 1922	125639 - 1953
1900 - 1892	45000 - 1923	131000 - 1954
2200 - 1893	47000 - 1924	153000 - 1955
2600 - 1894	49000 - 1925	144946 - 1956
2800 - 1895	50298 - 1926	151292 - 1958
3000 - 1896	52340 - 1927	162078 - 1959
3200 - 1897	53719 - 1928	168372 - 1960
3500 - 1898	55547 - 1929	171200 - 1961
4000 - 1899	56286 - 1930	172786 - 1962
4500 - 1900	59445 - 1931	176000 - 1963
4900 - 1901	60409 - 1932	180000 - 1964
6000 - 1902	61387 - 1933	191700 - 1965
7000 - 1903	61700 - 1934	194000 - 1966
8500 - 1904	62579 - 1935	200050 - 1967
10000 - 1905	65559 - 1936	200700 - 1968
11000 - 1906	66660 - 1937	213500 - 1969
12500 - 1907	68540 - 1938	220000 - 1970
15000 - 1908	69311 - 1939	222812 - 1971
19000 - 1909	71770 - 1940	225624 - 1972
21000 - 1910	74258 - 1941	228436 - 1973
23000 - 1911	78373 - 1942	301827 - 1974
26000 - 1912	80892 - 1943	375218 - 1975
28000 - 1913	84100 - 1944	448609 - 1976
29000 - 1914	89827 - 1945	522000 - 1977
30500 - 1915	91535 - 1946	

KEUFFEL & ESSER CO. NEW YORK.

**BOOK FOR SALE** "Journeys: One Individual's Excursions into the Surveying and Mapping Profession," Vol. 1, by Herbert W. Stoughton. For an autographed copy, send \$30.00 (includes S & H) to the author at 2821 Carey Avenue, Cheyenne, WY 82001. Proceeds will be donated to the Professional Surveyors of Wyoming scholarship program.

**TESSERACT, owned by SHS Members David and Yola Coffeen**, has been buying and selling scientific and medical instruments since 1982. Our website may be found at <http://www.etteract.com>. In addition to the web site, we publish several catalogues per year, each with dozens of instruments fully illustrated, described and priced, and are now up to Catalogue 101. Please contact us if you would like a single copy (\$10), or if you wish to subscribe (\$35 for four issues -- approximately one year). We are always interested in buying single items or collections. Address Box 151, Hastings-on-Hudson, New York 10706 USA telephone: 1-914-478-2594 email: [mail@etteract.com](mailto:mail@etteract.com)

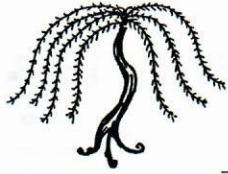
**THE MUSEUM OF MEASUREMENT & TIME (MoMT) IS OPEN** at 301 North Polk Street, Jefferson, Texas 75657; (903) 665-6668 (903-665-MoMT), featuring displays of land surveying and time-keeping devices, extensive library of Texas surveying records, meeting facilities available. Owned and operated by SHS Members Johnny & Edith Ingram; Free admission. [www.museumofmeasurementandtime.org](http://www.museumofmeasurementandtime.org)

**NOAA HISTORICAL MAP & CHART COLLECTION** is online, and contains over 35,000 images available FREE to the public. There are images of nautical charts, gravity maps, bathymetric and topographic maps, city plans, and sketches. Can be searched by geographic position, place name, chart number, year, document type, or keyword. Look for special collections, such as Civil War battlefield maps. Explore America at [www.nauticalcharts.noaa.gov/history](http://www.nauticalcharts.noaa.gov/history).

**BUYING OLD & ANTIQUE** field instruments, pre-1910 compasses, transits, unusual forms, solar, mining, unusually large or small instruments. D.R. Beeks, P.O. Box 117, Mt. Vernon, IA 52314 Phone: (319) 431-5031; email: [dbeeksci@gmail.com](mailto:dbeeksci@gmail.com)

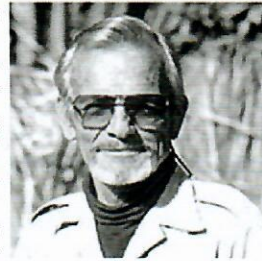
**ALL SHS MEMBERS** are encouraged to use this space; there is no charge. Send a postcard or email with your notice or advertisement to the Editor (address on pg. 15). Non-member's ads, also at no charge, will be considered if space allows. ■





## In Memoriam

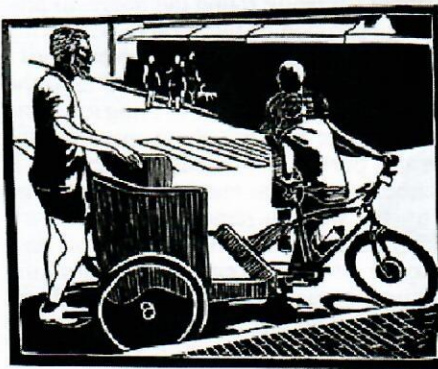
**David A. Goodman (1928-2017), SHS member #76.** Born in Paducah, Kentucky, Dave began surveying in 1950 after graduating from Union University in Jackson, Tennessee. He married Mary Benson that same year and in 1953 they moved to California. Shortly thereafter he went to work for the California Division of Highways and worked his way up through the ranks to be Party Chief, Field Supervisor, Chief of Surveys, finally retiring as Senior Transportation Engineer in 1991. But it was Dave's avocation as a premier archeological surveyor in Egypt that earned him honor and respect from academics, students, surveyors and even the Egyptian Department of Antiquities.



Dave's volunteer work began by chance in 1977, when his Caltrans supervisor George Katibah told him that a Berkeley professor was about to map all the tombs in the Valley of the Kings and Valley of the Queens, and, "he isn't going to take anyone who knows anything about surveying!" His interest in ancient Egypt dating from elementary school, Dave immediately volunteered, and then spent the next 23 years planning and developing control matrixes for the Theban Mapping Project, the Giza Plateau, and others including Saqqara, Abydos, Hierakonpolis, Gebel Barkal in the Sudan, and Ayla in Aqaba, Jordan.

In a 2013 interview for the California Surveyors' journal, Dave described his early project equipment, listing a Wild DI-10 EDM, Wild T-2 theodolite, pendulum level, HP 35 calculator, and a plane table and alidade. For the later Giza Plateau project (begun 1984), a borrowed Lietz TM1A theodolite and Leitz Red 2A EDM was employed.

Archaeologist Mark Lehner took notes for Dave, and in an article "High-precision measure of the landscape," described their Giza Plateau traverse control method: "We made four sets of observations at each station. If the averaged results of a set of four readings differed by more than five seconds of arc from the mean of all four sets, the observation was rejected and observed again. This level of accuracy is called second order by U.S. survey standards. David Goodman called it "Surveying to a gnat's eyelash!" (Rate of closure was 1: 326,750). Then, "We took four sets of observations between Polaris and two of our monuments using a synchronized digital watch to record the Greenwich Time at the moment of each sighting. Using standard ephemeris tables (NAO, 1984), Dave calculated the azimuth of Polaris at the exact time of each of the sightings. Azimuths were calculated for the rest of our eleven-course closed traverse." This was a loop around the Great Pyramids and the Sphinx, amid, as Dave put it, "magnificent works of arts in tombs and pyramids." His control networks are all in use today. Dave expressed his Egyptian surveying and mapping experiences this way: "HOW LUCKY COULD I BE!!!" ■



**William H. "Bill" Skerritt (SHS Member #651)** had a fine eye for detail, which served him well in his explorations of geology, fine art, and antique instruments. He was raised in Framingham, Massachusetts, but while attending Rensselaer Polytechnic Institute, its city of Troy, New York captured his heart. When he died suddenly on September 17, 2017, he left a large void to fill for Joanne, his wife of 34 years, his friends and colleagues, and the citizens of Troy.

Bill's geology degree led to long employment with the Materials Bureau of the New York Transportation Department. During his career, "I found that geology is as much art as a science," said Bill, "in that a lot of it is a visualization of the process you can't see happening, but that you know happened." He found that art was often the best way to communicate the science behind concepts he was trying to explain to politicians, engineers and others making decisions that affected roads and highways of the Empire State. Bill's personal artwork was mainly in the

printmaking mediums of white line woodblock prints and etchings, and he was a well-known exhibitor. He served on the Board of Directors for the Arts Center of the Capital Region. Of his art, Bill said, "I find inspiration everywhere." Bill had a passion for antiques, and in particular, the finely crafted surveying instruments made in Troy, an early epicenter of master makers. He corresponded with Silvio Bedini of the Smithsonian regularly, and performed researches of the extensive W. & L. E. Gurley records. In 1996 Bill produced a seminal book for the surveying historian's library, the "Catalog of the Charles E. Smart Collection: Antique Surveying Instruments." (Smart had reserved instruments traded-in for new Gurley models and built a company collection unparalleled in its scope and breadth). Bill also had a hand in celebrating Troy's industrial history, serving as President of the Board of Directors of the Hudson Mohawk Industrial Gateway. Because of Bill Skerritt's work, the arts of early American industries and craftsmen were not only celebrated, but may eventually lead to Troy's economic resurgence, as the Gateway members express in their motto, by "Putting the Past to Good Use."

Bill was a featured speaker at the Surveyors Historical Society 2016 Rendezvous in New York, where it was a real honor to experience his enthusiasm and expertise. As surveying instrument historian Dale Beeks noted, "He was such a good person and an important addition to those of us who studied the Troy/Albany school of makers." ■





## Serial Feature: Expedition down the Zuni & Colorado Rivers, 1853

By Capt. L. Sitgreaves

*Report of an Expedition down the Zuni and Colorado Rivers, by Captain L. Sitgreaves, Corps of Topographical Engineers Hon. C. M. Conrad, Secretary of War, Washington, D.C. February 7, 1853*

Sir: I have the honor to submit the accompanying map of the route explored by me from the pueblo of Zuni, New Mexico, to Camp Yuma, on the Colorado of the West, under instructions from you, of which the following is an extract: "The river Zuni is represented on good authority to empty into the Colorado, and it has been partially explored by Lieutenant Simpson to the pueblo of Zuni. You will therefore go to that place, which will be, in fact, the commencing point of your exploring labors. From the pueblo of Zuni you will pursue the Zuni to its junction with the Colorado, determining its course and character, particularly in reference to its navigable properties, and to the character of the adjacent land and productions. The junction of the Zuni and Colorado will be accurately determined. You will then pursue the Colorado to its junction with the Gulf of California, taking those observations which will enable you accurately to delineate its course."

The party was organized at Santa Fe, and consisted of Lieutenant J. G. Parke, Topographical Engineers; S. W. Woodhouse, M.D., physician and naturalist; Mr. R. H. Kern, draughtsman; Mr. Antoine Leroux, guide; five Americans and ten Mexicans as packers and arrieros [muleteers].

As many mules as could be procured in time, suitable for the purpose, were purchased; but these not being sufficient, the assistant-quartermaster at Santa Fe furnished me, on my requisition, with forty additional ones, with pack-saddles, &c. A portion of the provisions for the party were obtained from the assistant commissary of subsistence at the same place.



The commanding officer in New Mexico being about to make an expedition against the Navajos, directed me to await his departure, so as to take advantage of the protection afforded by his command as far as our routes coincided, or until he could detach a proper escort for my party. The troops assembled at Santo Domingo, on the Rio Grande, and took up their march thence on the 1st August.

On the 1st September we arrived at the pueblo of Zuni, the point at which my exploration was to commence.

I can add very little to the information afforded by the map, almost the entire country traversed being barren, and without general interest. Observations with the sextant were made as often as occasion served; and the latitude and longitude of as many points determined as are necessary to establish the line of march with sufficient accuracy. Collections were made of such objects of natural history as could be transported with our limited facilities. Their description will be found in the reports hereto appended. The expedition set out from Zuni the 24th September, 1851.

### *Medical Report of S. W. Woodhouse, M.D.*

On Wednesday morning, the 17th of September, 1851, while Lieut. Parke and I were walking out to procure some specimens of birds, when about two miles from Zuni, in passing along an Indian trail, I came within a few inches of treading upon a rattlesnake, which immediately coiled himself up and prepared to strike. Jumping back, I drew my ramrod, and with it struck him over the back, with sufficient force to break it. Being a fine specimen, I wished to preserve it without further injury, when, placing my gun on his head, and seizing it, as I supposed, immediately back of the head, picked him up; but unfortunately, I had too long a hold, when he threw round his head and buried his fang in the side of the index finger of my left hand. The pain was intense, but momentarily producing a sickening sensation. I immediately began sucking the wound; at the same time I got Lieut. P. to apply a ligature round the finger, to prevent the too rapid absorption of the poison. Scarifying the finger freely, I continued sucking the wound until I returned to camp. I sent a man, who was with us at the time, immediately back to the pueblo, to bring me some aqua ammonia fortis. He met me about three-fourths of a mile from the pueblo. I immediately applied it freely to the wound, when I was met by Mr. Kern, who wished me to try the western remedy; that is to say, to get drunk. This remedy I had often heard of, and, determined to try its efficacy, I commenced drinking whiskey. By the time I reached the pueblo I had drank about half a pint. During all this time I continued sucking the wound; then taking some ammonia internally, I scarified the finger, holding it in a basin of warm water, which allowed it to bleed freely. Already the glands in the axilla were getting sore and painful. I commenced drinking brandy; at the same time held my finger in a cup of ammonia. It took a quart of fourth-proof brandy, besides the whiskey, to produce intoxication, which only lasted some four or five hours. During this state I vomited freely. Soon after coming to my senses, I removed the ligature, and applied a large poultice of flaxseed-meal. I repeated the ammonia internally, and took some mass hydrg. [sic] and extract colocynth compound as a cathartic. In the evening the glands in the axilla were quite painful; so was also the finger; took pulvis Doveri, [ipecac and opium] ■

NEXT: The Expedition Will Go On





# Folkways:

## Seth Slocum Railroad Surveyor

"When Seth Slocum came to his senses, it was night, the stars were shining down on him; and he lay on the grass, with his head on something soft, which he found to be a dead body—that of an Indian.

Trying to turn his head, he felt a pain and stiffness in the back of his neck that reminded him he had been hurt; but managed to look from side to side, and found himself surrounded by camp-fires, tents and wagons, horses at picket-ropes, teamsters and soldiers stirring about in the usual routine of camp life, cooking and getting ready for bed.

No one seemed to notice him, till he managed to struggle up to a sitting position, when a voice called out to him: Hello? I thought you were gone up."

*(Seth was taken to the camp's doctor by an army corporal and examined).*

"You had a narrow escape, sir. How were you engaged when you were struck in the head?"

"I'm sure I don't know," said Slocum, in a weary way. "I think I was having a rough-and-tumble fight with an Indian, but I don't remember much about it."

Here the corporal saluted. "Please, sir. I saw the gentleman. He was cut off from our people, and he did fight like a team of wild-cats..."

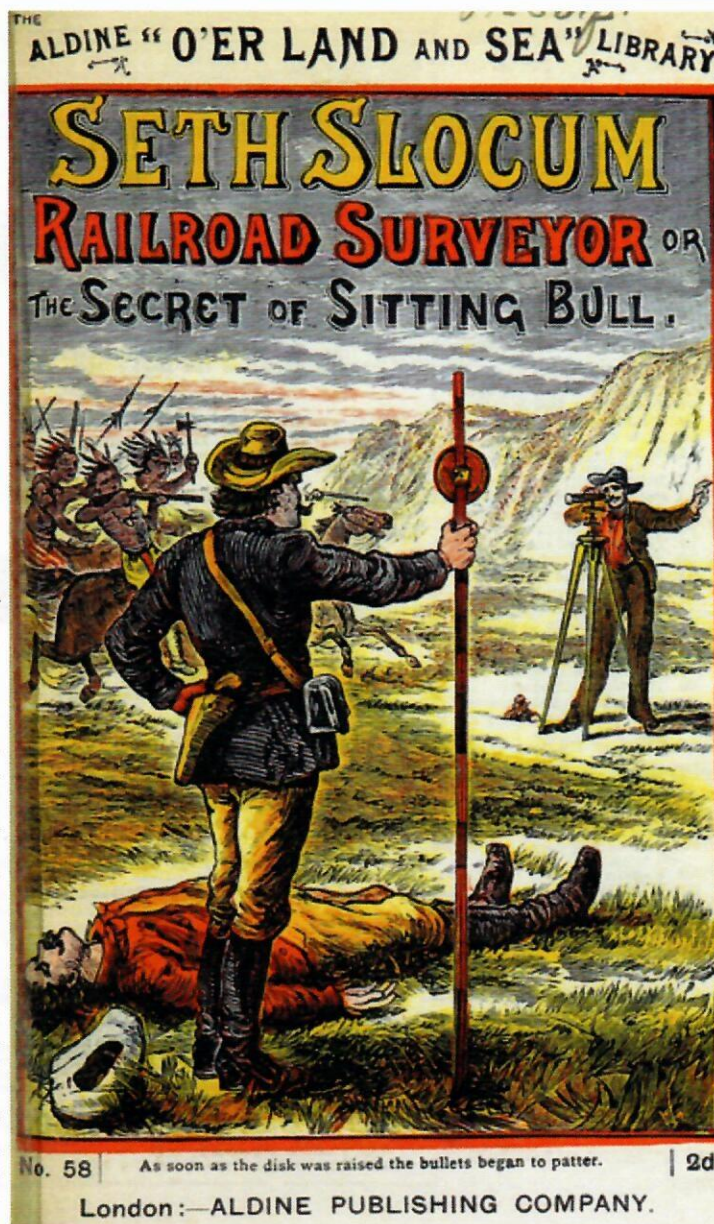
*(Seth learns that the Indians were driven away, but that his friend Mr. Graves was killed. Then the doctor continues:)*

"This fight has put a stop to the expedition and I hear that some valuable notes have been lost."

Slocum's head was too dizzy to take note of what was said, but he managed to ask the doctor:

"Is Mr. Russell here?"

The doctor nodded.



"Certainly. He's very much cut up about it. It seems there's some appropriation of Congress that was conditioned on this survey and now—"

"And what's lost? asked Slocum. "Not the field-book, surely?" "I believe that's what they said."

"Then I must see Mr. Russell at once," said Slocum, with great effort.

*(The doctor wants him to rest, but Seth prevails and is taken to General Chester and Chief Surveyor Mr. Russell).*

The general was pacing thoughtfully up and down, talking to Mr. Russell, when the doctor approached, and he wheeled round in his stern, imposing way to say:

"Well, doctor, well—what is it? We're busy."

"Can't help it, sir. Here's a gentleman who was badly hurt today; wants to report to Mr. Russell, and he'll have trouble with his head if he don't do it. He was with Mr. Graves."

Slocum, by a violent effort, cleared his head so far to say:

"Mr. Russell, I hear—you've lost—a field book."

Russell looked at him eagerly.

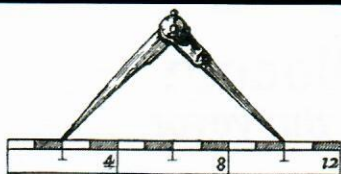
"Yes—yes. Do you know anything? Who are you?"

Slocum felt in his breast, and drew out the field-book with Graves' order in it, and handed it to the engineer, saying:

"I'm Seth Slocum, sir." ■

—from Chapter IV, "The Lost Field Book," excerpted from *Seth Slocum, Railroad Surveyor; or, The Secret of Sitting Bull: A Tale of the Great Northern Pacific Road-Building*, by Frederick Whittaker, New York: M. J. Ivers Co., 1903. (Series: Beadle's New York Dime Library no. 1074).





# K&E 1913 Stadia Hand Transit

Keuffel & Esser's "Stadia hand transit" was intended to "combine in one readily portable instrument facilities for measuring distances, ascertaining vertical angles and slopes, and taking compass bearings, the combined angle, grade and stadia readings being read simultaneously in the same field of view." Inventor Philip Ferber, "assignor to Keuffel and Esser Company" held several patents including US846989 – a form of transit frame and spindle, US901896 – a box tape reel, US933897 – an auxiliary telescope to mount on a standard transit, for plane surveying, solar observation, and mine surveying, and US975682 – the stadia hand transit. ■

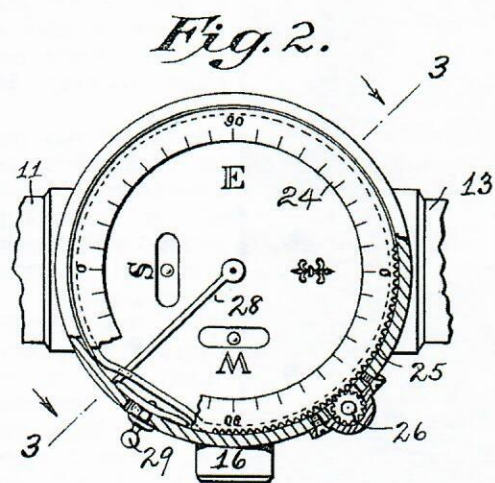
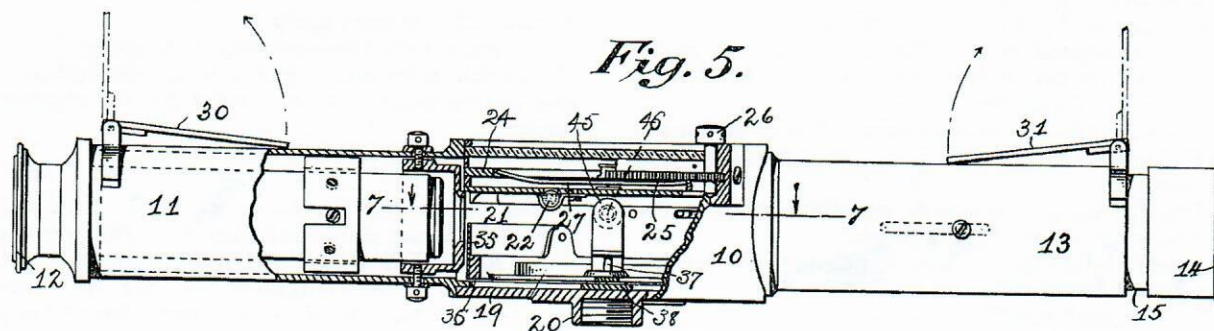


Fig. 2 - A side elevation of the compass side, with part of the outer case broken away to show the means of setting off the variation and locking the magnetic needle.

Fig. 5 – Stadia hand transit arranged in position for taking compass bearings.



KEUFFEL & ESSER CO. NEW YORK.

## STADIA HAND TRANSIT.

Patented

No. 5375.  
(Measuring vertical angles.  
Making stadia measurements.)

Appearance of field

No. 5375.  
(Taking compass bearings.)

No. 5375 L

**5375.** Stadia Hand Transit, achromatic terrestrial telescope 10 in., object glass 1 in., with cross hairs, and fixed stadia hairs ratio 1:100, folding sights. Clinometer and Altimeter formed by accurately balanced sensitive weighted ring with automatic stop, gives vertical angles to single degrees, and slopes in feet per 100 feet horizontal, or centimeters per meter. Compass 2 1/2 in., graduated on silvered raised ring to single degrees, variation plate set by capstan-head pinion, improved needle with jeweled centre, 2 spirit levels. Folding Ball joint and socket (No. 5348-2 F, page 420). Adjusting pin of phosphor bronze (which will not disturb the needle) for setting variation plate. In velvet lined sewed leather Case with shoulder strap . . . . each \$ 36 00

**5375 L.** Micrometer Leveling Attachment . . . . . " 8 50

The Stadia Hand Transit gives more accurate results than any similar portable instrument, and gives them in less time. In measuring vertical angles, the sighted object and the two scale readings (slopes and degrees) appear together in the field of view (see cut). Compass bearings can be sighted by the telescope on level ground or by the folding sights on sloping ground.

The Stadia Hand Transit is thoroughly well made and will meet the requirements of engineers and others who are engaged in preliminary work or in the subdivision of larger surveys made with a regular transit.

The Leveling attachment adds considerably to the accuracy of the Stadia Hand Transit, especially when sighting at long range.





# Surveyors Historical Society

www.surveyorshistoricalsociety.com

*"The SURVEYORS HISTORICAL SOCIETY documents the evolution of surveying and mapping through the collection and preservation of artifacts, records, and accumulated knowledge. The society seeks to use its unique and comprehensive repository of surveying material and the knowledge of its members to develop educational opportunities and support others engaged in similar efforts."*

## 2018 - 2019

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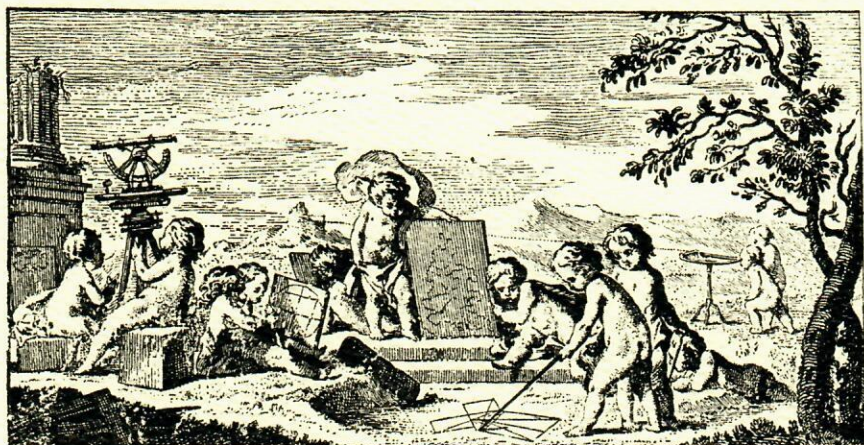
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#### *A Special Projects Fund*

raises money for worthy surveying history preservation projects. Donations to this fund will be used for this purpose only.

*Map cartouche from Maps and Map-Makers, by R. V. Tooley. NY: Bonanza Books, 4th imp. 1962.*





# MEMBERSHIP APPLICATION

Name: \_\_\_\_\_ Home Phone: \_\_\_\_\_  
Home Address: \_\_\_\_\_ City: \_\_\_\_\_  
State (Country): \_\_\_\_\_ Zip: \_\_\_\_\_ Email Address: \_\_\_\_\_  
Optional Firm/Agency: \_\_\_\_\_ Office Phone: \_\_\_\_\_  
Office Address: \_\_\_\_\_ City: \_\_\_\_\_  
State (Country): \_\_\_\_\_ Zip: \_\_\_\_\_ Send all SHS correspondence to: Home: \_\_\_\_\_ Office: \_\_\_\_\_

*Please note information will not be shared with other organizations; but your name, preferred address, preferred phone number, and e-mail address will be published in our annual membership roster distributed to SHS Members.*

\*\*\*\*\*

PLEASE CHECK THE APPROPRIATE MEMBERSHIP APPLIED FOR:

\_\_\_\_\_ Student (\$25) \_\_\_\_\_ Regular (\$75) \_\_\_\_\_ Life (\$750)

Annual dues as indicated ( ) are payable on January 1 for the calendar year.

Complete and mail this APPLICATION and indicated Annual Dues (US Funds) to:

**SURVEYORS HISTORICAL SOCIETY – 150 East Wilson Bridge Rd., Suite 300, Worthington, Ohio 43085**

\*\*\*\*\*

The following information enables S.H.S. to develop and update the member data base profile which assists in the evaluation of existing programs and the development of new activities. Please check or answer all that apply.

How did you learn about SHS? \_\_\_\_\_ What are your surveying-history interests? \_\_\_\_\_

Is it okay to publish your name, address & contact information in our annual Member Directory? \_\_\_\_\_ Yes \_\_\_\_\_ No

May we refer others to you with queries about similar surveying-history interests? \_\_\_\_\_ Yes \_\_\_\_\_ No

Do you belong to other surveying or historical societies? Please list: \_\_\_\_\_

Are you interested in helping with the work of the Surveyors Historical Society? If so, in what capacity: \_\_\_\_\_

Speaker at an SHS meeting or Rendezvous? \_\_\_\_\_ Topic(s) \_\_\_\_\_

Write a Backsights article? Topic(s) \_\_\_\_\_ Review a book? \_\_\_\_\_

Serve on a SHS committee? \_\_\_\_\_ Help with Backsights or SHS Rendezvous? \_\_\_\_\_ Other? \_\_\_\_\_

## BACKSIGHTS

Published by:

**SURVEYORS HISTORICAL SOCIETY**

**150 East Wilson Bridge Rd., Suite 300**

**Worthington, Ohio 43085**

*Address Correction Requested*

**TO:**

