CONTROL.

O HUNGER, Hunger, I will harness thee
And make thee harrow all my spirit's glebe.
Of old the blind bard Herve sang so sweet
He made a wolf to plow his land.

Sidney Lanier.

PARALLEL with the eastern and western shores of the bay of San Francisco, and flanking the beautiful and fertile Santa Clara valley south of that inland sea, stretch the inner and outer Coast Ranges of California. The inner range is the more commanding of the two, owing to its higher elevation and bolder front. It rises abruptly from a narrow plain bordering the eastern side of the bay; and, in one unbroken line drawn across the eastern horizon, it stretches southward until lost in the hazy distance. A person standing at the south end of San Francisco Bay and running the eye along the ridge of this range, after the sun has passed the meridian, will observe, almost due east, a point of light of dazzling brilliancy on the top of what appears to be a small flat-topped knob, no larger apparently than a half-section of a billiard-ball. The little knob is the summit of Mount Hamilton, the highest peak in the range, and named after the late Rev. Laurentine Hamilton; and the bright point of light is the reflection of the sun from the north dome of the Lick Observatory, from fifteen to twenty miles off as the crow flies.

The donor, James Lick, was born at Fredericksburg, Lebanon County, Pennsylvania, August 25, 1796. He began life as an organ and piano maker, first at Hanover, Pennsylvania, then at Baltimore, Maryland. In 1820 he started in business on his own account in Philadelphia, but soon after emigrated to Buenos Ayres, where for ten years he successfully prosecuted his trade. He subsequently moved to Valparaiso and later to California, where he arrived with a moderate fortune in the latter part of 1847. He spent the remainder of his days in California, dying in San Francisco October 1, 1876, leaving an estate worth nearly $4,000,000. He was such an unlovable, eccentric, solitary, selfish, and avaricious character that, it may be fairly said, had it not been for one of the last acts of his life, he would have died "unwept, unhonored, and unsung." This one act was a contradiction of his whole life. A little more than two years before his death Mr. Lick conveyed all of his great fortune by trust-deed to a board of trustees, to be divided mainly among public charities, and for the erection of important public, industrial, scientific, and hygienic institutions. For reasons never publicly explained, the instrument was twice revoked before his death, and a new board of trustees appointed each time, the last having been appointed only a month before he died.

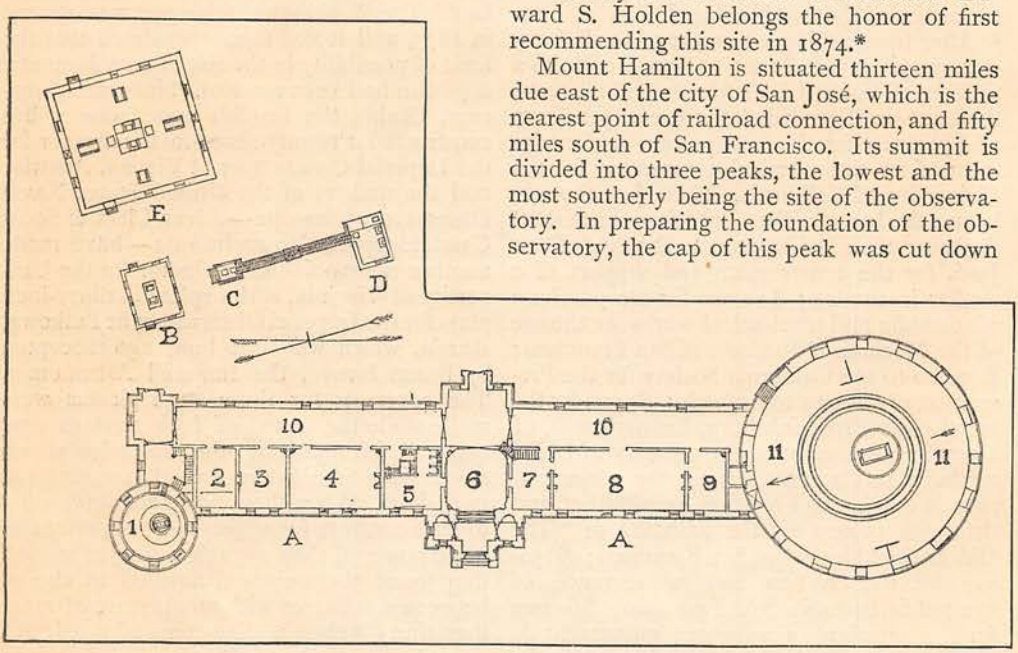
The Lick estate, at the time of James Lick's death, consisted largely of unimproved real estate in San Francisco and elsewhere in the State. The most important improved property was the hotel in San Francisco bearing Lick's name and the Lick mill near San José. In connection with the latter there is an interesting romantic story. It is said that in Lick's younger days he courted a well-to-do Pennsylvania miller's daughter, but his suit was successfully opposed by the old miller on

the ground of Lick's poverty. The erection of the mill near San José is said to have been the fulfillment of a vow, made at the time of his rejected suit, to build a mill which should be far superior to that of the Pennsylvania miller. He is reputed to have spent $200,000 in its construction. The interior was finished in costly California woods, highly polished. It is safe to say there never was built in the world a mill like it in this respect, and before it was burned it was regarded as one of the curiosities of the neighborhood.

After bequeathing a number of small legacies, ranging from $2000 to $5000 each, to a number of James Lick's friends and relatives, the trust-deed provided for the expenditure of $700,000 for the construction and equipment of an astronomical observatory for the University of California. Then $25,000 was bequeathed to the San Francisco Protestant Asylum; the same amount to the city of San José, for the construction and support of a similar institution; $10,000 for the purchase of scientific and mechanical works for the use of the Mechanics' Institute of San Francisco; $10,000 to the California Society for the Prevention of Cruelty to Animals; $5000 for the erection at Fredericksburg, Pennsylvania, of a granite monument to the memory of Lick's mother; similar amounts for the same purpose in respect to his father, grandfather, and sister; $100,000 for the founding of "The Old Ladies' Home" at San Francisco; $150-000 for the erection and maintenance of free public baths in San Francisco; $60,000 for the erection of a bronze monument in Golden Gate Park, San Francisco, "to the memory of Francis Scott Key, author of the song, 'The Star-Spangled Banner'"; $100,000 for a group of bronze statuary representing the history of California, to be erected at the City Hall of San Francisco; $540,000 for the founding and erection of a California School of Mechanical Arts; and $150,000 to John H. Lick. To avoid what threatened to be a long, costly, and uncertain lawsuit, involving the sanity of James Lick and the validity of the trust-deed, the trustees increased the amount assigned to John H. Lick to $535,000. After all these bequests shall have been paid, the residue of the estate, if any there be, is to be divided equally between the California Academy of Sciences and the Society of California Pioneers, both of which organizations had previously received donations of valuable pieces of real estate from Mr. Lick.

From the foregoing it will be seen that an observatory for the University of California was the most cherished of all of Mr. Lick's pet schemes of public benefaction. There is good reason to believe that he had nursed the idea for a great many years before he began to put it into practical shape. His ambition concerning it knew no bounds. He imposed the obligation in the trust-deed of erecting "a powerful telescope, superior to and more powerful than any telescope yet made." At the time the trust-deed was made the largest telescopes in existence were the twenty-six-inch refractor in the Naval Observatory at Washington, D. C., and Lord Rosse's six-foot reflector at Parsontown, Ireland. The Washington telescope was erected in 1873, and it was then considered that the limit of possibility in the size of an achromatic objective had been reached. Since then, however, Grubb, the English manufacturer, has constructed a twenty-seven-inch refractor for the Imperial Observatory at Vienna, Austria; and the makers of the United States Naval Observatory telescope — Alvan Clark & Sons, Cambridgeport, Massachusetts — have made another twenty-six-inch refractor for the University of Virginia, and a splendid thirty-inch glass for the Imperial Observatory at Pulkowa, Russia, which was not long ago accepted by Baron Struve, the Imperial Astronomer. The contracts for these large glasses were made while the board of Lick trustees were engaged in removing the obstacles which stood for a time in the way of executing the trust-deed. When they were, therefore, ready to let a contract for a telescope "superior and more powerful than any telescope yet made," they found themselves compelled to choose between a refractor with an aperture of more than thirty inches in diameter and a reflector exceeding seventy-two inches in diameter. Their choice was in favor of attempting the former. In January, 1881, they contracted with Alvan Clark & Sons for the manufacture of "an achromatic astronomical object-glass of thirty-six inches clear aperture" (this being the largest the Clarks would venture to contract for), to be delivered November 1, 1883. The price was fifty thousand dollars, of which amount twelve thousand dollars was paid when the contract was signed. The flint-glass disk was successfully cast by Feil & Sons, Paris, France, early in 1882, and has since then been in the hands of Alvan Clark & Sons. Its companion, the crown-glass disk, was cast and ready for shipment at the close of 1882, but the material was so brittle that it unfortunately cracked in packing. The difficulties attending the casting of the crown disk have been extraordinary. No glass of the dimensions required had ever been cast or attempted before the Lick Observatory contract was awarded to the Clarks. Thirty or more blocks were cast by the Feils before one was obtained that would be acceptable.

The wrecks are arrayed along the walls of their factory as curiosities. The first block, as has been already stated, was broken in packing for shipment. Many contained irremediable flaws. Others were destroyed in annealing, and others again were damaged beyond repair in cooling. At one time the prospects of the great telescope appeared hopeless. The elder Feil had retired from business, leaving his glass-works in charge of his sons.



GROUND-PLAN OF LICK OBSERVATORY.

A. Main building; B. Transit house; C. Heliostat; D. Photograph house; E. Meridian circle house.
1. North dome; 2. Clock-room; 3. Shop; 4. Dormitory; 5. Visitors' room; 6. West hall;
7. Secretary's room; 8. Library; 9. Director's office; 10. Long hall; 11. South dome.

They made a great many castings and experiments in annealing, but without success. To make matters worse, they went into bankruptcy. Alvan Clark then expressed his doubts of such a large glass ever being successfully made, deeming it among the impossibilities. At this stage in the history of the telescope, the elder Feil took charge of the establishment, and after several more failures succeeded in casting and annealing a satisfactory glass. The cheerful intelligence was communicated in the early part of September, 1885, that the glass was then being prepared by Feil for shipment to Alvan Clark & Sons. It will take the Clarks a year to grind and polish the glass, after it reaches their manufactory.

James Lick reserved for himself the selection of a suitable site for the observatory destined to bear his name. A spur of the Sierra Nevada near Lake Tahoe, Mount St. Helena, Mount Diablo, and Mount Hamilton in the Coast Range, were brought forward as candidates for the honor. After considerable deliberation and frequent consultation with good authorities, Mr. Lick decided in favor of Mount Hamilton, the little knob in the inner Coast Range already referred to. The wisdom of his selection has since been abundantly demonstrated. To Professor Edward S. Holden belongs the honor of first recommending this site in 1874.*

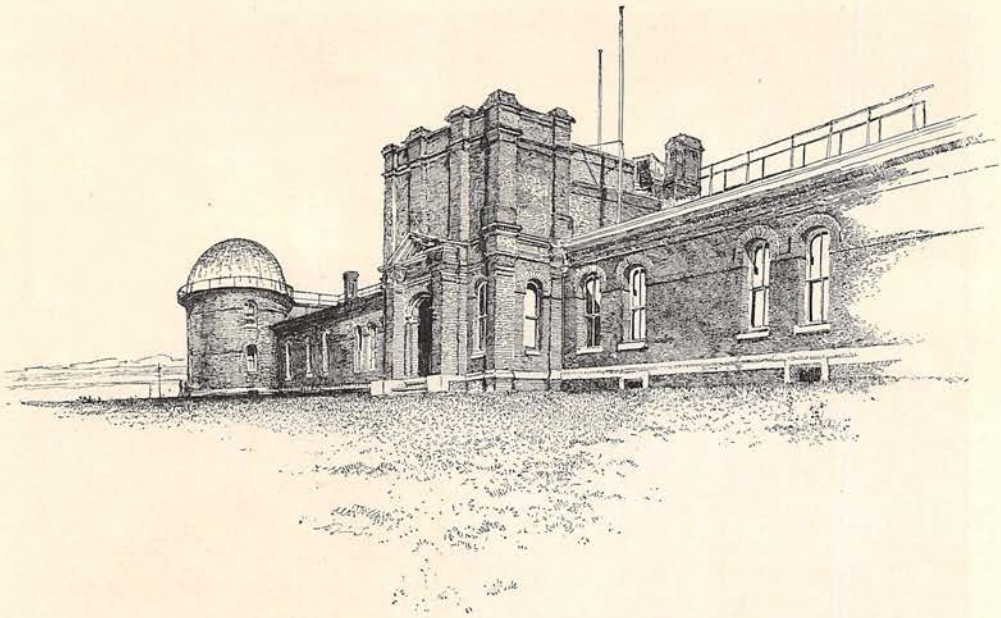
Mount Hamilton is situated thirteen miles due east of the city of San José, which is the nearest point of railroad connection, and fifty miles south of San Francisco. Its summit is divided into three peaks, the lowest and the most southerly being the site of the observatory. In preparing the foundation of the observatory, the cap of this peak was cut down thirty-one feet. Viewed from the Santa Clara valley, Observatory Peak presents a horizontal line against the blue sky in the background, four thousand two hundred and eighty-five feet above the level of the sea.

Before the selection of Mount Hamilton was made, the land was fortunately in the hands of the Federal Government. Through the agency of Aaron A. Sargent, then United States Senator from California, Congress made a grant of sixteen hundred acres, embracing a circle of over one mile below the summit of the mountain, for the uses of the observatory. An additional tract of one hundred and ninety acres of timber-land — principally black oak — was secured with University of California land scrip. The total domain of the observatory is consequently seventeen hundred and ninety acres.

* Professor Holden has since accepted the Presidency of the University of California.

SUMMIT OF MOUNT HAMILTON, LOOKING SOUTH FROM RESERVOIR PEAK. (FROM A PHOTOGRAPH BY LORYEA & MACAULAY.)

Inasmuch as the site was practically inaccessible, Mr. Lick made the selection of Mount Hamilton conditional on the construction of a suitable wagon-road to the summit by the county of Santa Clara. The condition was accepted, and in due season a road was built, at a cost of seventy-five thousand dollars. This thoroughfare, which is known as Lick Avenue, is twenty miles and a half in length, and is one of the best roads west of the Rocky Mountains. The grade in no place exceeds six feet and three-quarters in one hundred feet. There is no part of it where a carriage team cannot trot comfortably up the grade. Before reaching Lick Avenue from San José, there is a delightful drive of five miles and a half along a splendidly macadamized and level road called Santa Clara Avenue, which passes by some of the most noted vineyards and orchards in the State, and is lined on each side with a double row of Monterey pine and cypress, the vigorous, sturdy growth of the former contrasting strongly with the delicate foliage and shapely branches of the latter. The twenty-six miles from San José to the top of Mount Hamilton can be made with a reasonably good team in four hours, the return trip in three hours; and there are few pleasanter or more picturesque drives in California. The road in ascending the range for many miles overlooks the beautiful valley, whose strawberry patches, onion gardens, vineyards, orchards, and wheat-fields make a charming piece of natural patchwork, extending twenty miles or more to the south. Two small valleys within the inner Coast Range are crossed before the foot of Mount Hamilton is reached. One of them, Hall's Valley, is largely under cultivation. But the "greaser" or native Californian element predominates among its inhabitants. One of the "ranch" houses, which nestles close to the roadside under the broad branches of an old live-oak tree, will suggest to the wayfarer a Pike County home, and a glimpse of the lank, unkempt tenants will make the suggestion all the stronger. The farm stock have their home under the broad veranda of the one-story cottage, and the poultry find a roost under its roof. But the larger portion of the valley is carefully cultivated, and the vine and the fig-tree are conspicuous among its products. Smith Creek, at the base of Mount Hamilton, is a favorite rendezvous for camping parties from the cities. The gurgling stream abounds in trout, and the mountain slopes and gorges in the neighborhood are full of game. Smith Creek is seven miles by the road from the observatory, but it is only two miles in an air-line. Looking up the almost vertical flank of the mountain, a glimpse of the glistening dome, apparently close by, is to be had. In these two miles the road has to overcome a vertical rise of nearly two thou-



LICK OBSERVATORY, WEST VIEW, SHOWING MAIN ENTRANCE AND NORTH DOME. (FROM A PHOTOGRAPH BY H. E. MATHEWS.)

sand feet, and ascends in a zigzag course. At some points a dozen laps of its windings can be seen at one glance within a distance of half a mile. Near the summit it winds twice around the peak.

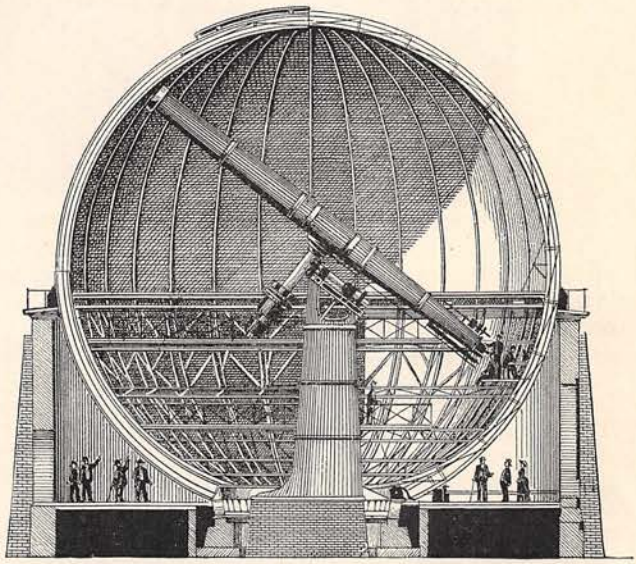
On the saddle of the ridge uniting the three peaks of the mountain, a cozy cluster of white frame buildings nestles in the shadow of Observatory Peak, which protects it from the keen west wind. The village consists of the superintendent's residence and office, the cabins used by the men employed at the observatory, a blacksmith shop, outhouses for live stock, etc. The ridge is so narrow that the rear half of the superintendent's residence hangs on a slope steeper than the roof of a house, and a few feet from the front is the other slope of the mountain, which is quite as abrupt; and there is no change in the grade on either side for at least a thousand feet.

Work was begun on Lick Observatory July 23, 1880. Few people have any conception of the difficulties which had to be overcome before the enterprise could have hoped of success. Everything — food, tools, building materials, and water — had apparently to be carried to the top of the mountain from the valley. For a long time after work began it was so in fact. Water used for all purposes had to be hauled from Smith Creek. Subsequently a small spring was discovered three hundred and ten feet below the summit of Observatory Peak, and a road seven-eighths of a mile in length had to be constructed to reach it. The highest of the three peaks, which is one mile north-east of the site of the observatory, was selected for reservoir purposes, and on it tanks having a capacity of eighty-seven thousand gallons were erected. Subsequently a large reservoir, capable of holding at least three hundred thousand gallons of water, was excavated in the solid rock, and carefully cemented, as a substitute for these tanks. A small reservoir of similar construction has also been established on the smaller of the three peaks of the mountain. By the use of steam force-pumps and a long line of pipes the water is now raised from the spring into the reservoirs, and by another system of pipes it is conveyed by gravitation through the settlement and to the observatory. The daily capacity of this spring is never under ten thousand gallons in the driest season.

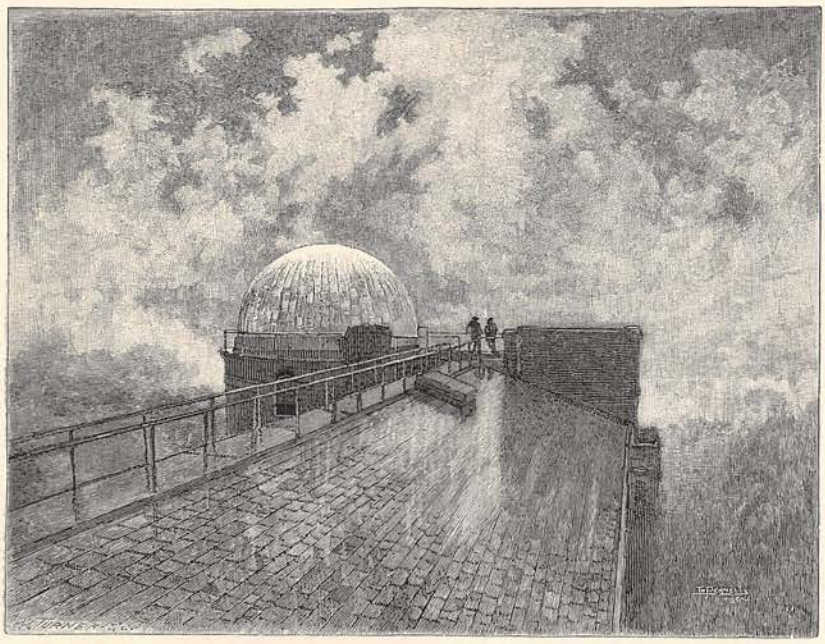
Lumber, cement, lime, stone, and all other building materials had to be hauled from the valley below. Fortunately a bed of excellent brick clay was discovered on a small bench on the west slope of the mountain, eight hundred feet below the summit, but two and one-half miles by the road, and adjacent to it was a spring of water heavily charged with sulphur. All the bricks used in the erection of the massive walls of the observatory were made on that spot, effecting thereby an enormous saving in labor and money. The sandstone caps for telescopic piers, window lintels and sills, etc., were quarried in the outer Coast Range near Gilroy, at the south end of Santa

Clara valley. There was not an ounce of anything suitable for the work where it was needed — on the summit. Even the trap-rock excavated in preparing the foundation, although hard as flint, rapidly decomposed when exposed to the weather. Thus for five years the work has been pushed ahead; but it will be at least two years more before the observatory will be ready to be transferred to the regents of the University of California, in accordance with the provisions of the trust-deed.

The plan of Lick Observatory provides for a structure two hundred and eighty-seven feet in length, a transit house, meridian circle, a photo-heliograph and heliostat, and a photograph house. The main building stands nearly due north and south and fronts the west. The domes are at each extremity. The south dome will contain the great telescope. Its foundations have been laid in the solid rock, deep enough to be below the reach of frost; but it cannot be finished until the focal length of the telescope shall have been determined, and that cannot be done until the objective glass shall have been made. This dome will be the largest of any observatory in existence. Its great size presents many difficult problems for solution. Correspondence has been carried on by Captain Floyd, the president of the board of trustees, with the best-known astronomers of all countries, touching the various details of the work. An immense volume of this correspondence has accumulated. The outcome of it all has been the devising by Captain Thomas E. Fraser, a very clever young engineer, who has been in the employ of the trustees as superintendent of construction since work began, of a dome which shall be a seven-eighths sphere, resting and revolving on a tower seventy-five feet in circumference. The object of the seven-eighths sphere dome is manifold. In the first place, the friction in moving it will be a minimum. A hemisphere dome of the same diameter would rest on a tower having a circumference of two hundred and seventeen feet. The tower would need be of enormous strength to carry the weight, and the friction in revolving the dome would offer a resistance over one hundred per cent. greater than the seven-eighths sphere. For the seven-eighths sphere, which is likely to be adopted, unless some fatal defect not yet revealed shall in the mean time be detected, the external tower will be raised level with the greatest diameter of the dome. The frame of the dome will be of steel. The inside of the envelope of the upper hemisphere will be of paper, and the outside of steel plates. The lower half of the sphere will be a mere skeleton of the framework. Around it there will be two fixed galleries for observers, assistants, and students. The observer's chair will be hung opposite the shutter, sliding on an arc nearly corresponding with the arc of the eye-piece of the telescope. This chair will be twenty-two feet in length and five feet in breadth. Shutter and chair will be of nearly corresponding weight, and under the personal control of the observer. As the chair ascends, the shutter will slide down into the lower hemisphere, ascending again as the chair descends. By this arrangement, and with the aid of a supplementary shutter overlapping the opening above, there will be only so much of an opening in the slit of the dome as will be absolutely necessary to expose the objective of the telescope. With the galleries and chair so arranged and adjusted, and the broad aisle under the framework, which has a floor surface of two thousand square feet, the seven-eighths dome will contain much more spare room than a dome on the ordinary plan furnished with a movable ladder-chair. The aisle will afford room for an astronomical library, for visitors and other purposes, without interfering with the working of dome, chair, or shutter, as would be the case in other systems. The observer in the Lick dome will be able to perform all his work at the eye-piece



THE GREAT DOME AND TELESCOPE.
(FROM A DESIGN DRAWN BY CAPTAIN THOMAS E. FRASER.)

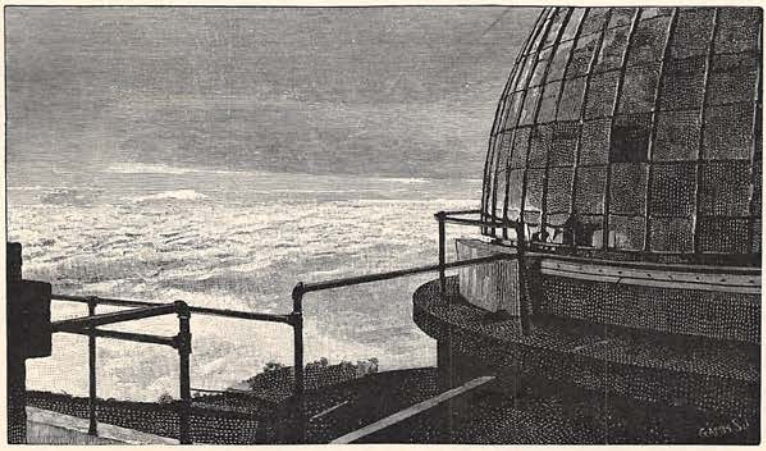


NORTH DOME, FROM THE ROOF OF THE OBSERVATORY. (FROM A PHOTOGRAPH BY H. E. MATHEWS.)

of the great telescope free from intrusion or interruption, and he will be saved the fatigue and loss of time incurred in ascending and descending a ladder-chair thirty feet or more in height. The dome will weigh fifty tons. It will roll on an endless harnessed carriage. The sole and bed plates will be perfectly protected from any variations of temperature, so that there will be no trouble from expansion and contraction. The following table shows approximately the ratio of quantity of material, cost, and resistance to motion of a hemispherical dome compared with a seven-eighths sphere, both being sixty-five feet inside diameter:

	½ sphere.	*⅞ sphere.*
Quantity of metal	1	1.1
Quantity of masonry	1	.59
Cost of metal	1	1.26
Cost of masonry	1	.61
Total cost of dome	1	.915
Total weight above rollers	1	1.35
Length of track in one revolution	217 feet	75 feet
Resistance to motion	1	.46

Shutter, chair, and dome will be moved by hydraulic power, controlled by the observer in his chair, after a plan devised by Captain Floyd.

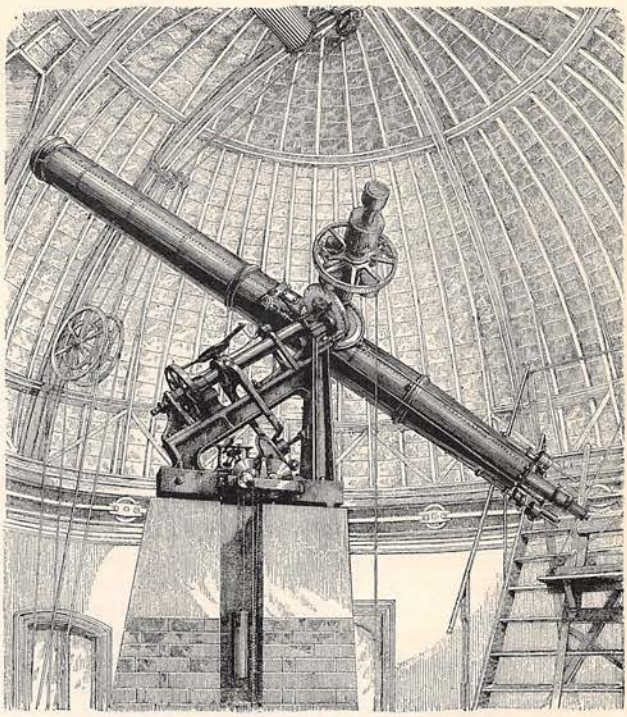


A SEA OF FOG, LOOKING WEST FROM OBSERVATORY PEAK. (FROM A PHOTOGRAPH BY LORYEA & MACAULAY.)

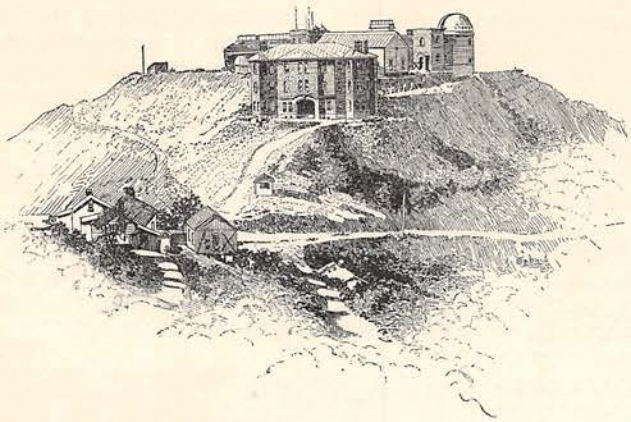
Pending the completion of the thirty-six-inch objective by the Clarks, Captain Fraser's plans have been submitted to the criticism of American and foreign astronomers, photographs of the drawings and copies of the specifications having been sent to them. Interesting criticisms — some favorable and some unfavorable, but none affecting the feasibility of the plans — have been received from accomplished astronomers. A working model six feet in diameter, made by Captain Fraser with his own hands, gives perfect satisfaction.

The north dome, which has been finished for some time, contains a splendid twelve-inch equatorial made by the Clarks, which has been mounted for more than three years. This dome is twenty-nine feet six inches in diameter. It is twenty-four feet in height, and thirteen feet five inches in diameter at the base and eight feet at the top, which is capped with a block of Gilroy sandstone, on which the telescope is mounted. In the base of the pier is a large vault for the storage of valuables. It is considered one of the finest structures ever built to sustain a twelve-inch equatorial. Midway between the two domes is a broad central hall, opening on the west and the east sides, to the right of which, looking westward, are the visitors' room, dormitory for observers, and clock room; to the left, the secretary's room, library, and computors' room.

The framework of the north dome is made of steamed bent oak. The covering is thin copper sheeting, plated inside with tin and outside with nickel. It is this bright nickel covering reflecting the sun's rays which makes the dome visible afar off. Through the employment of these light materials, the weight of the dome has been reduced to a minimum. It consequently requires less effort to revolve it, and there is less strain on the walls of the tower. The shutter covering the opening through which the telescope is pointed is a rolling sheet of corrugated steel, attached to wire ropes sliding on friction-pulleys. The sides work in grooves discharging into the drain-channel of the dome, so that when the shutter is down no moisture can get inside. This shutter when rolled up is only one foot in diameter, and is far enough back to give the observer at least six inches clear in the zenith. It is worked by endless wire ropes conducted to pulleys attached to the lower side of the dome opposite the slit, which are set in motion by hand-ropes. The dome revolves on a harnessed endless triple-wheeled carriage and double track. The outer and inner wheels run on these tracks. The middle wheel receives the friction of the iron girder forming the base of the dome. Guide-wheels run on an inside plate, and a clutch grips a rim on the upper edge of this plate, anchoring the dome securely to the tower. An endless wire rope running in a groove around the outer rim of the tower, over a couple of large pulleys, and then through the wall to a drum set in a recess inside, is the simple machinery used for revolving the dome. It is now worked by hand, and can be operated easily by a child. It is intended ultimately to work this and all other machinery in the observatory by hydraulic power. Suitable piping has been laid under-ground throughout the building to carry water for domestic use and hydraulic power and for gas, with which the structure may be illuminated hereafter. Hydrants have been placed at convenient intervals along the pipe line, from the spring to the reservoir, and from the latter to the observatory, for use in case of fire in the buildings or in the chaparral on the mountain slopes.



INTERIOR OF NORTH DOME — THE TWELVE-INCH TELESCOPE.
(FROM A PHOTOGRAPH BY LORYEA & MACAULAY.)



RESIDENCE OF OBSERVATORY ASTRONOMERS. (FROM A PHOTOGRAPH BY H. E. MATHEWS.)

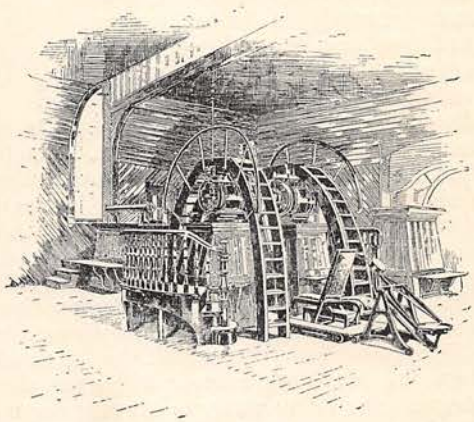
The transit house is east of the north dome, and is made of corrugated galvanized sheet iron, standing on a foundation of brick set in the solid rock. It contains, besides a four-inch transit instrument, a sidereal clock — a splendid timepiece — of Amsterdam make, two chronometers made by Negus of New York, a chronograph, and a portable four-inch comet-seeker. The wooden shutter is worked by means of a lever, and is so nicely balanced that, although weighing five hundred pounds, a pull of ten pounds is sufficient to raise it.

The photo-heliograph and heliostat, photograph house, meridian-circle house, a large brick residence for the astronomers employed at the observatory, and all of the main building, excepting the south or great dome, have been completed. The meridian-circle house has double walls, the outer one being of iron and the inner of wood. An equable temperature is thus secured in the interior. It contains a six-inch meridian-circle of the best quality, constructed by A. Repsold & Sons, of Hamburg, which is the pride of the observatory. Adjoining the meridian-circle house, but lower down the eastern slope of Observatory Peak, is the astronomers' residence, a large double brick structure. A covered passage joins the upper story to the meridian-circle house, which will enable the astronomers to pass to and fro without exposure to the weather. No part of the main building of the observatory, excepting the north dome and the library, has been furnished. The library contains already about fifteen hundred bound volumes, all carefully selected, and also a large number of unbound pamphlets and magazines pertaining specially to astronomical matters. A telegraph and telephone line connects the observatory with the system of the Western Union Telegraph Company at the city of San José.

The view from Observatory Peak is magnificent in its range and varied beauty. Excepting a small patch in the north-east, which is shut out by the other peaks of the mountain, the horizon in every direction is unobstructed. Half a dozen towns and cities may be seen or located within a radius of fifty miles. Through the depressions in the outer Coast Range, lying west of Santa Clara valley and twenty miles off, may be seen at sunset the waters of the Pacific Ocean. The Sierra Nevada, one hundred and thirty miles to the east, come out sharp and distinct at sunrise. A snow-capped peak, supposed to be Lassen Butte, one hundred and seventy-five miles distant, is occasionally visible in the north. On an exceptionally clear day a full-rigged ship with all sail set has been observed through a glass emerging from the Golden Gate and entering San Francisco Bay, fifty miles off. The country lying to the north, east, and south-east is very rugged. The valleys are deep and narrow. One of the gorges in the vicinity of Mount Hamilton is reputed to have been a favorite retreat of Joaquin Murietta, the famous bandit whose name was a terror to the early settlers of the State. A spring, situated a mile and a half east of Observatory Peak, at which he is said to have drawn water, now bears the name of "Joaquin's Spring." The outlaw could have selected, in those days, no securer retreat. He was perfectly safe in it from pursuit, as it was then practically inaccessible. The gap in the outer Coast Range caused by Monterey Bay, now one of the most popular watering-resorts in California, is visible in the south, and the outline of Salinas valley is traceable in the hazy distance beyond.

Dense fogs are among the atmospheric phenomena common to the California coast. The west wind, which blows almost every afternoon through the summer season, brings up a great bank of fog from the ocean as the sun sets. This rolls inshore in the evening, filling the coast valleys, and enveloping the outer Coast Range. It pours into Santa Clara valley from the Golden Gate on the north, and from Monterey Bay to the south, and climbs the flanks of the inner Coast Range during the night. This sea of fog, from the summit of Mount Hamilton, is a weird and beautiful sight in early morning before the sun has had time to dissipate it. It resembles nothing so much as the heaving, wavy ocean whence it came, excepting that it differs from it in color. Its fleecy surface glistens like burnished silver. On no occasion has this great fog-bank ever been known to overtop Observatory Peak. In November, 1882, during a strong gale, the fog was driven higher up the mountain than ever before, so far as is known, reaching the four-thousand-foot line. The phenomenon was so interesting that a photograph of the scene was taken from the roof of the observatory. It is rarely that these coast fogs reach an elevation of two thousand feet, as determined by observations made by Professor George Davidson, of the United States Coast and Geodetic Survey, and their average height is fifteen hundred feet. This freedom from the coast fogs greatly enhances the value of Mount Hamilton as a site for an astronomical observatory. The trade-winds, which drive the fog inshore, blow strong and steady all night long on the summit through the summer season, frequently attaining a velocity of thirty miles an hour, and humming a cheerful melody in the ears of the observer in the dome.

The approximate geographical position of Observatory Peak has been determined by Professor S. W. Burnham, of Chicago, at longitude 121° 21′ 40″ west and latitude 37° 21′ 3″ north. The great altitude and southerly position of Lick Observatory give it a zone of fifteen or twenty degrees farther south to sweep with its telescopes than any other American or any European observatory. It was this fact, and the purity and steadiness of the atmosphere on the mountain, that enabled Professor Burnham, during a sojourn extending from August 17, 1879, to the 16th of the following October, to catalogue forty-two new double stars with the aid of a six-inch refractor temporarily mounted in a small canvas dome. One of these double stars was 47° 18′ south declination. "Close pairs," he says, "can be observed at least down to 43° south declination." Of the sixty nights then spent by Professor Burnham on the mountain, he found forty-two nights to be first-class for astronomical purposes, seven were medium nights, and eleven were cloudy and foggy. On the first-class nights he was able to use the highest powers advantageously, getting "sharp, well-defined images," and he was able to measure satisfactorily "the closest and most difficult double stars within the grasp of the instrument." On medium nights "only moderate powers, say up to 200," were profitably used. It is claimed that the astronomer may be sure of at least 250 good nights in every year on Mount Hamilton, 150 of which will be such as are rarely enjoyed at any of the Eastern observatories.

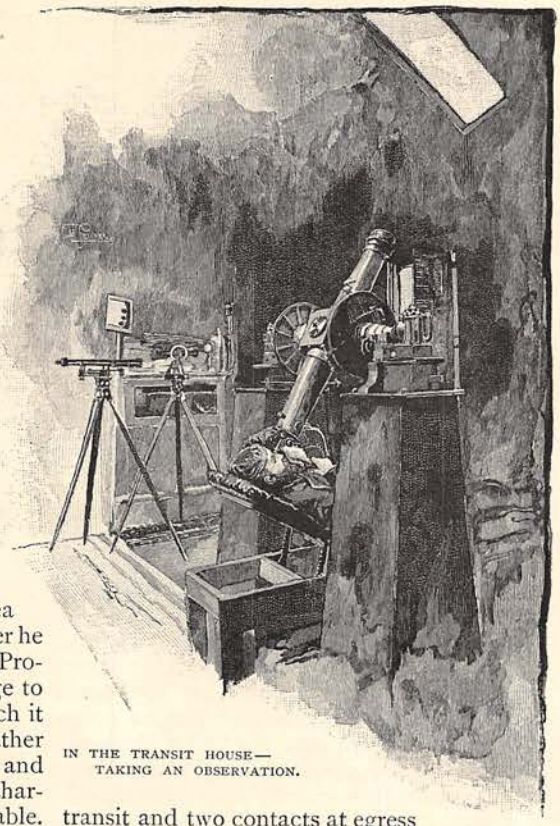


INTERIOR OF MERIDIAN-CIRCLE HOUSE.
(FROM A PHOTOGRAPH BY H. E. MATHEWS.)

The atmosphere on Mount Hamilton is remarkably dry. It is a condition which has charmed the professional soul of every astronomer that has visited it. "The average difference between the wet and dry bulb thermometers" Professor Burnham found for the first five weeks of his stay to be 18° 4′, "giving, by Blanford's tables calculated for a mean barometer, 25.8 inches, a relative humidity of about .27. . . . The lowest relative humidity was .06. . . . The average daily maximum temperature in the shade, for the first five weeks, was 88°, and the minimum 64°. The thermometer at 9 P. M. would ordinarily be 12° or 15° lower than at 3 P. M. . . . During the last two weeks a much lower temperature was reached, on one occasion the minimum thermometer indicating 30°." As the summer and fall weather of one year in California is like that of every other year, the results noted by Professor Burnham may be accepted as fairly applicable to the summer and fall weather of any year at Lick

Observatory. In the winter the snow accumulates to the depth of about four feet, and gales are not unusual, although the greatest velocity recorded is under fifty miles an hour. The snowfall sometimes temporarily cuts off communication with the valley, reaching two thousand feet down the mountain's sides.

The transit of Mercury in 1881 was successfully observed at Lick Observatory by Professor Edward S. Holden; and Professor Simon Newcomb at one time thought of adopting it as his station for observing the transit of Venus, December 7, 1882. An examination of the meteorological record of the mountain and of the State generally, as far back as such had been kept, showed, however, an unfavorable condition of weather prevailing on or about that date. Professor Newcomb therefore abandoned the idea and went to the Cape of Good Hope. After he had thus decided, President Floyd invited Professor David P. Todd of Amherst College to direct the observations of the transit which it had been fully resolved should be made, weather permitting. The invitation was accepted, and the results were of the most satisfactory character. The weather was remarkably favorable. The air was absolutely tranquil, the sky cloudless, the temperature never falling to sixty degrees, and rising nearly to seventy degrees in the shade at noon. Observations of the transit and two contacts at egress were made by Captain Floyd with the twelve-inch equatorial, and of the contacts by Professor Todd with the four-inch transit instrument, mounted on its reversing carriage. But the most important work of the day was photographic. One hundred and forty-seven plates were exposed, of which one hundred and twenty-five were available for micrometric measurement. The Mount Hamilton photographic record of the transit of Venus has since been treated, in computing the general results, as among the most valuable of the observations of that rare and interesting celestial phenomenon. A triplicate of these photographic records and certain materials used in making them, which may have to be referred to in computing the results, form the first batch of strictly original scientific data stored in the vaults of Lick Observatory.



IN THE TRANSIT HOUSE—
TAKING AN OBSERVATION.

INTERIOR OF THE PHOTOGRAPH HOUSE.

Of the larger public institutions provided for in James Lick's trust-deed, the observatory is the only one which the resources of the estate have as yet enabled the trustees to do anything with. The property constituting the estate might have been disposed of years ago, but it would have been at ruinous prices, and some of Mr. Lick's benefactions would never have been consummated. Only such property has been sold as commanded a fair

price and as was necessary to dispose of to pay the expenses of the observatory and the personal legacies and private monuments named in the trust-deed. To the trustees the administration of the estate has in a great measure been one of love. The compensation allowed each one in the trust-deed is only one thousand dollars per annum. Up to the 31st of August, 1885, there had been spent on the observatory three hundred thousand dollars. What it will cost by the time it is completed cannot be stated. But the trustees believe that of the seven hundred thousand dollars assigned to the observatory in the trust-deed, there will be enough left, after the structure is finished and the great telescope mounted, to constitute a fund for the perpetual maintenance of the institution (including the regular employment of an efficient corps of astronomers) by the regents of the University of California. There remains, however, only the south dome, for the reception of the great telescope, to build. Its dimensions will depend upon the focal length of the telescope. As soon as that shall have been determined, work on the dome will begin. Its foundations have already been laid, and the bricks for its walls are on the ground. It is the belief of the trustees that they will be able to transfer the observatory to the University regents in 1887.

Strange to say, James Lick made no provision in the trust-deed or any other written instrument for the disposition of his remains; but some time during the last year of his life he expressed a wish to a friend that his body be buried on Mount Hamilton, within or adjacent to the observatory. In the base of the pier sustaining the great equatorial telescope, it is intended to construct a vault thirty feet in diameter and the same in height. In this vault the body of James Lick will probably find its last resting-place. He was a solitary in life, and in death he will also be isolated. But the observatory, from which there are hopes of great accomplishments in the future, will be his magnificent tomb and monument, as well as a precious instrument for the advancement of the most sublime of the sciences.

Taliesin Evans.

TO WILL H. LOW:

IN ACKNOWLEDGMENT OF THE DEDICATION OF HIS DRAWINGS FOR KEATS'S "LAMIA."

YOUTH now flees on feathered foot.
Faint and fainter sounds the flute,
Rarer songs of gods,—

And still
Somewhere on the sunny hill,
Or along the winding stream,
Through the willows, flits a dream;
Flits, but shows a smiling face,
Flees, but with so quaint a grace,
None can choose to stay at home,—
All must follow—all must roam.

This is unborn beauty: she
Now in air floats high and free,
Takes the sun, and breaks the blue;—
Late, with stooping pinion flew
Raking hedgerow trees and wet
Her wing in silver streams, and set
Shining foot on temple roof.
Now again she flies aloof,
Coasting mountain clouds, and kissed
By the evening's amethyst.

In wet wood and miry lane
Still we pound and pant in vain;
Still with earthy foot we chase
Waning pinion, fainting face;
Still, with gray hair, we stumble on,
Till—behold!—the vision gone.

Where has fleeting beauty led?
To the doorway of the dead:

Life is gone, but life was gay:
We have come the primrose way!

Robert Louis Stevenson.

The above verses and the following words from his letter to his friend are here printed by permission of the author:

"I have copied out on the other sheet some verses, which somehow your pictures suggested: as a kind of image of things that I pursue and cannot reach, and that you seem—no, not to have reached, but to have come a thought nearer to than I. This is the life we have chosen; well, the choice was mad, but I should make it again."