THE GREAT SAN FRANCISCO EARTHQUAKE.

BY PROF. EDGAR L. LARKIN.
Lowe Observatory, Echo Mountain, California, June 6.

"Swing low sweet chariot," let mercies fall and shower down blessings on the sorrowful, and "let voices once breathed o'er Eden" sing. Let the tuneful strains be soft, low and plaintive, not too low, just loud enough for two hundred thousand suffering human beings to hear. And let the voices seem to come out of space, for there would not be room for a grand choir, no place for the singers.

Golden Gate Park, that paradise of botanical splendors, plants with leaves like lace, sub-tropical flowers and wilderness of leaves, that dream of the tourist, that Mecca for those who love the beautiful, suddenly filled with fleeing thousands from wild flames and a quaking earth.

"Seething fire followed fast and followed faster." Hosts and multitudes hurried over whole banks and terraces of flowers, the park was soon filled and thousands poured into the two adjacent cemeteries; others rushed for the beach, even to the Cliff House and to the waters of the Golden Gate.

The Pacific was startled with the onrush of the terror-stricken. I walked during two days along narrow passage-ways amid the never ending thousands of homeless refugees. I talked with them and listened to their awful story. Nature in the parks tried to hide the misery. Great blooming hydrangeas did hide one family of fire from gaze, and a mass of flaming poinsettias gave shelter to a woman and her daughter who were ill. A clump of violets covered with a handkerchief, made a pillow for a little girl burning with fever. Heliotropes, carnations, a hundred kinds of roses, verbenas, geraniums and the glorious poppies of California vied with each other in striving to attract attention away from the appalling scene of misery, suffering and dismay, but in vain.
Entire thousands were without blankets, sheets or pillows, their entire possessions consisted of the clothing they wore, a few rescued pillows and spreads, and during two nights they remained here with the earth for a bed.

The cemeteries were impressive to behold. The great areas were simply strewn with thousands of overturned monuments, shafts, pillars and obelisks.

**NO. 1. FALLEN MONUMENTS.**

*B* marks the position of base and *M* of the monument in each case.

One of my objects in leaving the peace and quiet in the Observatory on the mountain, to make a five hundred mile journey to the stricken city, was to study the action of the earthquake in the great cemeteries, for these are the best places in which to see the full effects of the displacement of the earth’s surface. The fallen columns write the history of the convulsion in stone. At first I thought that a general trend or direction could be made out, but found that the pillars were pointing in every conceivable direction.
Cut No. 1 gives an idea of the confusion that reigned in the two cities of the dead. I had no instrument with which to measure azimuths or amplitudes, but judging by the eye alone, it seemed that the fallen columns pointed all the way from five to seventy degrees from the directions of their sides before their overthrow.

The earthquake was of the typical circularly gyrating form. The displacement of monuments that remained standing is shown in Cut No. 2.

Some of these weigh tons, so that the force required to slide them laterally, against enormous friction, was strong indeed. Granite was ground into fine powder under the bottoms of the displaced shafts. Pure snow white marble angels were thrown into beds of flowers, and one snowy wing was imbedded in a terrace all covered with violets.

Exquisite sculptures, statuary, wreaths in marble, and carved capitals were strewn over hundreds of acres in almost bewildering confusion. Little marble hands holding wreaths, scrolls and tablets were broken off and cast into flowery banks; and one cherub ever so white and pure was resting in a bed of daisies, and the stone eyes looked out on a fringe of lilies. But then there were the living round about the tombs. The half dead made their homes with the dead. Weak and wan girls played with the marble angels and gathered fragments of the statuary. One desolate family found shelter in a beautiful sepulchre, while the sufferers rested their heads on lowly graves.

On Friday night, April 20, an ocean wind blew damp and cold. Dense fog settled down on the two hundred thousand, by midnight an almost icy rain fell upon them in this now memorable night of appalling misery. From all accounts it is believed that eighteen little babies were born in the midst of the tempest. The darkness was like that of Egypt, due to smoke mixed with fog. No lamp or candle relieved the terrible gloom, and babies came into this troubled world.

Let the twenty-one Buddhistic hells be concentrated into one, and let Jonathan Edwards picture it in fiendish glee, or Dante write; and both would fail utterly in any description of this mind- and brain-crushing night of horrors.

I could scarcely study the fallen columns for the suffering on every side.

And then the mighty nation came to the rescue. Food, blankets, tents and guards were distributed by the government. Martial law reigned, and California arose in its majesty and poured hun-
dreds of car-loads of provisions into the doomed city. It was a most impressive and pathetic scene, this giving of food to the starving.

THE MARVELOUS PROCESSION.

After delays due to a congestion of the railroad, the writer arrived in San Francisco, fifty-one hours after the first shock. On stepping off the boat at the foot of Market Street, I knew that I was in an earthquake area. The earth was rent in many places. The street railway was bent up and down in sinuous curves and one track was a foot lower than the other. The earth had descended vertically. Square miles of tottering walls, columns and naked frames of structural steel, made up a frightful scene of desolation.

The entire northern half of the city was then burning. The dull thunders of falling walls, the roar of the flames and sharp detonations of dynamite, conspired to make a horrible vision of destruction.

Against a sable canopy, a blackened pall of smoke, the mighty columns of the Fairmount Hotel on Nob Hill stood out in pure white, a scene of classic beauty. But boiling flames, tumbling palaces, crushing marble, exploding dynamite, burning ships and docks, soon lost attraction for me.

Close at hand was a moving thing of pain, a struggling, toiling, living object, and has history anything to surpass what I gazed upon during four hours?
This most remarkable and new historic object was the interminable procession of escaping thousands of people from the peninsula of San Francisco. Thousands upon thousands were moving slowly and painfully towards the ferry boats leading across the bay to Oakland. A hundred thousand poured into that city, Berkeley and Alameda.

My objective point was the cemetery, four miles away. It took four hours to walk this distance over almost impossible débris. The entire distance was occupied by the long drawn column of frenzied people. Babel was eclipsed, and the confusion of tongues more confounded. An incredible number of languages was heard. The world was represented in varying speech; and the nations, races, types, and kindreds of the earth were in a marvelous review. The

linguist, anthropologist, and mentalist, all students of human nature, had a wonderful opportunity there in the sorrowful way. The people saved their living creatures. Canary birds, parrots, pet rabbits, puppies, squirrels, guinea-pigs, all household pets, were carried by those scarcely strong enough to drag themselves along. This was one of the most pathetic scenes in the ruins. And then the dollies; little girls toiled along with dolls that required their strength to carry. But the living dolls, the babies, suffered in the lime-dust cutting and biting in their tiny eyes. And poor, sobbing mothers struggled over hot bricks, acres of broken window glass, twisted columns, beams and girders of iron; and then the sticky
asphalt pavements contained nails, spikes, bolts, broken glass dishes, crockery, chinaware, and sharp fragments of stones.

But the wilderness of tangled wires was simply unendurable. How they tripped and fell, with their feet enmeshed in inextricable network, loops and knots of twisted wires. And their lungs were filled with corrosive gases and vapors rising from hot basements. I saw enough misery in the four dreadful hours to make one ask, What is human existence for? And then, after passing the struggling thousands, I stepped into beautiful Laurel Hill cemetery and I asked myself the same question again with emphasis.

THE MIGHTY CONVULSION.

I have received letters from every part of the troubled area. Many of these are of great value for they were written by those having passed through upheavals of the solid earth before. They knew what to observe, such as intensity, time, direction, amplitude of oscillation, and vertical lift or depression. From all these accounts, and from studies of seismographic records from the north and south sides of the disturbed region, and from the central portion, and from observations in the cemeteries, it seems that the earthquake was circular, or roughly elliptical. A number of letters tell of thrust, horizontally at first, but changing rapidly into circular motion as noted in swinging lamps.

This now historic convulsion presented in one grand upheaval almost every kind of impulse, motion, activity, and turbulence known in earthquakes. By closely studying this colossal display of force one can become familiar with all kinds, nearly, of earthquake phenomena. The successive impulses were vertical, horizontal, to and fro, circular, gyratory, inclined and undulatory. The strata in the earth below the entire area of disturbance were in the clutch of a twisting, wrenching, distorting monster.

Strain, tension and pressure were tremendous. An example of titanic power is given by an immense chimney in the western part of San Francisco. The entire upper half had been lifted clear from the lower half, turned around about twenty degrees, and gently lowered without injury. These things must have occurred for the bricks where the rupture took place are intact and not ground to powder. The top half weighs hundreds of tons, and if twisted around without being lifted up, whole layers of brick would have been ground into fine dust like the granite bases of the laterally displaced monuments.

Different kinds of phenomena were occurring at the same time
in widely separated regions. This fact is brought out clearly in the letters. A wave in the earth might be undulating in one place, while in another sharp beats, thumps and twists were in violent activity. Landslides down the mountains, and into the sea would obtain here and there, while the surface was rising elsewhere. Springs burst forth in places and ceased to flow in others. Blue lights appeared in a number of localities dancing over land as well as water. Their appearance and colors were like those of static electricity escaping from the terminals of electric influence machines. Gases escaped from the soil and sea, having pungent sulphurous odors. Subterranean sounds as of rolling carriage wheels over plank bridges, and of deep rumblings and reverberations were heard in

No. 3. April 18, 1905, 5:15 A. M. "**No. 4. April 25, 1906, 3:17 P. M."

SEISMOGRAPHS TAKEN AT THE VETERANS' HOME, NAPA COUNTY, CAL.

many places, not only on April 18, the day of the upheaval, but on the 17th.

Many persons have written me from several directions from the stricken city, saying that they and many others heard masked and muffled sounds from deep within the earth, and also concussions of explosive violence. One of the most vivid, awe-inspiring and impressive facts derived from these letters, and from conversations with many while in San Francisco, and from letters written in the city limits, is this: the people in the city did not hear subterranean sounds.

But the awful reason why was because of the terrible roar roundabout, from seething flames, tumbling walls, the crashing of glass and the hissing of sliding rasping miles of wires. The literature of earthquakes does not present a more striking and startling
fact, for the roaring of the city, all aflame, was louder than the thundering in caves of gloom below.

Cut No. 3 is that of a most valuable seismograph secured by Mr. F. M. Clarke, executive officer of the Veterans' Home, Napa County, California, forty-five miles north of San Francisco.

A seismograph consists of a fine needle attached to a heavy weight which is suspended by a thin cord from a rigid support. A plate of smoked glass is placed under the needle whose point touches the carbon film. The needle points toward the center of gravity of the earth, and is at rest in relation to the earth's center owing to the inertia of the massive body to which it is attached.

If the surface of the earth moves, it carries the smoked glass with it, and the needle marks a faithful trace in the soot. The curious lines in Cut No. 3 are those actually marked by the surface of the earth at 5.15 A. M., April 18, in Napa County California.

A number of rapidly weakening shocks succeeded during seven days, and Cut No. 4 is a final record made at 3.15 P. M. April 25. The oscillations of the earth were so slight, that the lines are jumbled into a confused knot as shown. These records are of great interest, for they show the beginning and end of the great earthquake.

All the accounts of blue lights are of scientific value, but that sent by Engineer J. E. Hauser, from San Jose, California, is remarkable.

"On April 18, I awakened five minutes before our clock struck five. I heard a rumbling noise as of distant thunder. Two mares with young colts were running and whinnying in an adjacent lot, in alarm as though dogs were after them. Dogs were there, but they too gave unusual warning of danger. At 5.12 my bed jumped from under me, the movement starting from a standstill.

"The force seemed to raise up the house and turn it to the right upward and left downward, with tremendous power, so forcible as to tear me loose from the door frame to which I was clinging with both hands, my wife holding around my waist.

"We both could see down Alameda Street, looking eastward, and we both saw the whole street ablaze with fire, it being of a beautiful rainbow color, but faint. We passed out into the street and met a man who asked, 'did you see the fire in Alameda street?' An hour later a friend told me that the ground all around was a blaze of fire."

Now this no doubt was an electrical display, for had gas been on fire all along the street, the houses would have been ignited. And
a letter from a point north of San Francisco describes blue lights as flickering like an Aurora, over wide area of marsh land, with a troubled surface of adjoining water.

And can it be possible that the giant electricity took part in the vast seismic turbulence?

I have a large collection of descriptions which must be omitted. The writer scarcely knows which one of the multitude of theories regarding the cause of earthquakes to adopt.

Pent up steam, gases, chemical activity, faults, shrinking, warping, crumpling of strata, contracting of the external shell on the liquid interior, settling, rising and distortion, together with sunspots, causing a variation in the earth's electrical potential and magnetic, and a dozen other hypotheses are found in the books. Of these I have decided to adopt the doctrine of "faults" in this earthquake.

There are rents, breaks, cracks and seams in the rock strata of the earth. There is an ancient fault in California. It appears on the coast south of Mendocino County, far north of San Francisco. It extends along a few miles inland and follows the coast southward, passes under San Francisco Bay, onward through Santa Clara County near San Jose, and extends to the south line of San Louis Obispo County. Here it makes a sharp turn to the east, and reaches the northeast corner of Los Angeles County.

There it bends to the south, passes eastward of the city of San Bernardino, and moving over toward the south, disappears beneath the waters of the Gulf of California.

This primeval scar has been traced by the expert Mr. A. S. Cooper, for more than five hundred miles. In some places one wall of the slip or fault is 500 feet higher than the other.

The San Francisco earthquake was due to a readjustment of the edges of the layers once torn apart when the earth was young. Since the convulsion that laid a proud city low, Professor Branner of the Stanford University explored the ancient rent for forty miles south of San Francisco, and discovered that the archaic wound had re-opened exposing fresh edges of the ancient layers.

In the Santa Cruz Mountains, he found lateral displacement of four feet, and vertical two. This is sufficient to have produced the earthquake.

In Golden Gate Park I saw a displacement of two feet and a vertical of ten inches. The fault approaches the sea south of San Francisco a few miles, and an extensive landslide, forming a new point jutting into the ocean, occurred near there.
Faults, notably those in great mountain chains of solid rock, are very slow in re-adjustment, and it may be that centuries will elapse before another upheaval comes. But then they will have scientific buildings, almost completely earthquake- and fire-proof. Bricks will be obsolete.

Between the eruption of Vesuvius and the California earthquake I was able to secure only four observations of the sun. Few spots were on display, the largest being twice as large as the earth,—far too small to amount to anything. The position of the sun, moon, Mercury, Venus, Mars, Jupiter, and Saturn on April 18 were such that they were massed within five hours twenty-eight minutes of Right Ascension. This brought them in the same region in the sky. And they all combined to pull the earth off its orbit and nearer to the sun. The consequence was that the earth was 618,000 miles nearer to the solar globe on April 18th, 1906, than it was on April 18, 1905.

But our world has often been off its track farther than this without earthquakes. So all things considered, it is perhaps well to think that the great upheaval was due to the simple mechanical readjustment of an ancient fault that appeared when the earth was adolescent.

I have received seventy-four accounts. The appearance of blue lights was over a wider area than at first thought. In Petaluma Creek the water splashed up as though thousands of stones were dropped into it; and blue flames eighteen inches in height played over a wide expanse of marshland. At Sausalito an odor of sulphuretted hydrogen escaped from the earth. A blowhole in sand was formed on the beach near Colma, near the fault, and the sulphurous odors were pungent in Napa County during the night of the 17th and 18th, before the upheaval, and lasted all day.

At 5.00 P. M. before the turbulence “A flickering luminous haze” was seen playing above the ground, and during the oscillations “Many crevices were formed in the plains and mountains of Napa and adjoining counties whose surface strata are of white trachite, with disintegrated serpentine and porphyry, friable and permeable to gases.”

From many of the letters it is clear that the entire region north and east of San Francisco is saturated with gases of sulphur origin, far beneath, or it may be near the surface. The world-famous Napa Soda Springs have increased flow from 60 to 100 per cent., and the temperature has increased. A spring near the Veterans' home, writes Mr. F. M. Clarke, has increased flow from 200 to 1000 gallons per day, while others ceased flowing.
Landslides are reported from every part of the wide area of seismic troubles where there are hills and mountains and cracks in plains.

A fault extends from Santa Rosa north of San Francisco to Salinas, south. Santa Rosa was nearly destroyed and disturbances occurred at Salinas. This fault also bends towards San Francisco from Santa Rosa. It appears that two faults were involved.

I have a mass of facts that cannot be mentioned in less space than a good sized book.

Thus the convulsions were felt on the surface, but not by miners below. Electricity might have been at work, the earth has a potential, and this might have been exerted in some way near the surface only. One remarkable fact is this, the immense Bay of San Francisco is filled and emptied by tides. The volume of water is enormous, and if forced through the narrow Golden Gate, the current would be rapid indeed. No such velocity exists, hence there may be an underground connection with the ocean.

Many fish were killed along the coast and as far south as Los Angeles. And fish taken from the sea opposite Los Angeles, had such a strong odor of sulphur that they could not be eaten.

Recent pumice stone has been gathered from the Pacific, two hundred miles at sea. John T. Reid, Lovelocks, Nevada, writes that a room there had a clock on each wall, those facing south and west stopped at 5.15 A. M., while those facing north and east kept running.

An artesian well at Calistoga, California, grew ten degrees hotter and the flow increased. Creeks became milky in several places as if gas escaped with the water.

In San Francisco, gyratory motions were shown in railway tracks. The immense Fairmount Hotel had the widest cracks near the corners.

I have many reports of waves in the earth, of twisting out, and of circular swinging in suspended lamps.

A dark funnel shaped mass was seen in Fourth Street, San Francisco, suspended in the air, and it was illuminated by scintillating lights like fire-flies. Blue flames were seen hovering over the bases of foot-hills in Western San Francisco.

Vast damage was done to the classic buildings at Stanford University, but the Lick Observatory near stricken San Jose, was spared, the costly instruments are intact.

I do not wish to assert that the earth's charge of electricity
helped in the havoc, but believe that it did. That giant is able to do any vast work.

The appearance of bluish flames in so many different places on land, and also on the sea are very impressive phenomena, and suggest electricity. The drying up of springs and opening of others, the changes of the temperature of the water are an evidence of a shifting in the rock strata.

The rolling, rumbling sounds beneath and also thumps and beats in the earth, of explosive violence may have been due to subterranean thunders.

Cut No. 5 is absolutely unique in the entire literature of earthquakes.

\[\text{NO 5. DIAGRAM OF EARTHQUAKE LINES.}\]

Made by the dropping of oil on machine-shop floor at Lobetos, Cal. Drawn by Jerome Hamilton. The scale represents a length of seven inches.

In Lobetos, California, a cup of oil was suspended from the ceiling of a machine shop by a string. The remarkable series of curves shown is an exact reproduction. The actual size of a trace made on the floor by a thin stream of oil that was thrown out of the cup by the earthquake. This trace is of great value as it shows the precise motion of the earth's surface, and is a marvelous seismograph.

This earthquake will become historic; great questions arise: did man appear on earth before his dwelling was ready? Pelee, Vesuvius, Lisbon, Galveston, San Francisco, all appeal to the imagination. Does Nature care whether man exists? It is estimated that she has slain thirteen million human beings by convulsive force alone within the historic period.