was about two to four seconds; in the principal portion it varied from ten to twenty seconds.

"The San Francisco earthquake, besides being recorded the world over on specially designed earthquake instruments called seismographs, likewise affected the self-recording magnetic instruments at the three magnetic observatories of the Coast and Geodetic Survey thus far heard from.

"At the magnetic observatory at Cheltenham, Md., this disturbance began about half-past eight A. M., Eastern time, on April 18, and continued for about half an hour. This disturbance began some time after the preliminary tremors, coinciding with the principal portion of the disturbance as recorded on the seismograph.

"It affected chiefly the horizontal and vertical components of the earth's magnetic intensity, the greatest disturbance amounting to one one-thousandth part of the horizontal intensity and about one two-thousandth part of the vertical intensity. It was not of the same character as that due to a cosmic magnetic storm or as that recorded in connection with the Mont Pelé eruption, but appears to be chiefly if not entirely mechanical.

"At Baldwin, Kan., where there is no seismograph, the magnetic instruments also recorded a similar disturbance, lasting from twenty-two minutes after eight to half-past eight, Eastern time, some time after the preliminary tremors of the earthquake had reached Cheltenham.

"At the Sitka Observatory this disturbance was also recorded by the magnetic instruments from twenty-four minutes past eight to thirty minutes past eight, Eastern time, somewhat later than the preliminary tremors recorded on the seismograph at this observatory.

"It is to be noticed that in each of these three cases the magnetic disturbance occurs at about the same time that the greatest motion is being recorded on the seismograph.

"The question whether the earthquake disturbed the magnetics in a purely mechanical way or by its action on the earth's magnetism is by no means settled. In fact, it is only recently that attempts have been made to study the phenomena. Up to the present the results are contradictory. At times the magnetic disturbance is simultaneous with or actually precedes the preliminary tremors. In other cases, like the present one, it accompanies the principal portion of the disturbance.

"In some cases of large earthquakes no magnetic effect can be detected and in a few other cases, notably March 21, 1904 (New England earthquake), the shock was recorded at Cheltenham by the magnetic instruments, but was not recorded by the seismograph either at Baltimore or Washington."

## SAN FRANCISCO AND ITS CATASTROPHE.

Fortunately it is seldom that one great elemental catastrophe follows close upon the heels of another. Usually Nature seems to stop and draw breath before beginning a further alteration in the envelope which restrains her greatest forces. The full horror of the devastation which last week swept San Francisco and adjacent cities, burst upon us before we had even fairly concluded that the Neapolitan disaster had reached its full extent. The earthquake which was the ultimate cause of the destruction of the greatest American city on the Pacific coast was incomparably the severest ever recorded in the United States, and was accompanied by the loss of hundreds, if not thousands of lives, and the destruction of property valued at hundreds of millions. But the full extent of the cataclysm was hardly realized until it was found impossible to check the progress of the fires which immediately sprang up at innumerable points among the ruins of collapsed buildings. The earth tremor destroyed almost the entire water system of the city, and the local fire department, as well as the assistance sent from other cities, was practically helpless. Dynamite and even artillery were used without effect to stay the sweep of the flames, and at the present writing San Francisco is the scene of a conflagration which is said to overshadow even the recent great fire of Baltimore, and which has rendered over 300,000 people homeless and helpless. To the terror of fire has been added the suffering entailed by lack of food and water, for railroad communication with the wrecked city has been all but destroyed and even telegraphic connection was not re-established till hours after the first shock.

That the native energy, courage, and resourcefulness of the Californian will raise upon the ashes of San Francisco a greater and more splendid city is certain; nor will the lessons taught by the destruction be lost. As far as can be learned from the meager reports obtainable it appears that solid masonry structures collapsed like so many houses of sand while more modern structures with steel skeletons were damaged to a far slighter extent. If true, this is doubtless because of the elasticity of the riveted framework, while the rigidity of solid masonry was of no avail against the rising and falling of the earth under the foundations. The severest damage due to the shaking of the earth itself was caused in that part of the city that was built on reclaimed land, and it seems that here even modern structures were unable to resist the sinking of the earth.

It would seem that the disaster of San Francisco, following so closely upon the great eruption of Vesuvius, could, in some manner, be traced to an origin at least analogous to that which caused the latter. It is the consensus of opinion, however, of scientific men, that the earthquake on the Pacific coast is of local origin. It is probable that the tremor was due to the slipping or fracturing of some great stratum or of several strata of rock either directly underlying the city or under the Pacific Ocean nearby. That the center of the convulsion was either under the land, or not far from the shore, is shown by the fact that no great annihilating sea wave resulted, like that which made the great earthquake of Lisbon, in 1755, so terribly destructive. On that occasion a great tidal wave passed clear across the Atlantic Ocean in nine and a half hours, and the effect of the shock itself was felt even in England. The Pacific coast which lies in an earthquake belt quite distinct from that which includes Southern Italy is peculiarly susceptible to disturbances of this nature. The present configuration of the soil is of recent geological age, and the coast, unlike the Atlantic shore line, shelves rapidly to deep water, and thus the slipping of rock strata, which is usually the cause of non-volcanic convulsions, is greatly facilitated. It is for the same reason that the Japanese islands and the Asiatic coast are so frequently the scenes of earthquakes, some of which, especially in Japan, have been of terrific intensity. It is quite true that volcanic eruptions and earthquakes are liable to occur simultaneously, but in the case of California a connection should be sought between its earthquakes and the condition of the volcanoes, either along the Pacific coast, or on the groups of volcanic islands in that ocean. In the last great earthquake of 1868, in which San Francisco suffered severely, there appears to have been undoubted connection between the tremor and the intense volcanic outburst in the same year of the Hawaiian volcanos, Kilauea and Mauna Loa, which probably directly caused the strata settling which give rise to the surface movement.

That the earth is extremely sensitive even to the slightest shocks, contractions, or alterations is shown by the tremendous rapidity with which the indications of these are transmitted to various parts of the globe. A few minutes after the first shock was felt in San Francisco the seismographic instruments at Washington recorded the tremor. A tremor of slight intensity would be sufficient to start the rearrangement or readjustment of a poorly balanced or heavily strained mass of strata underlying the earth's crust, and so, while we cannot directly blame Vesuvius for the Californian catastrophe, it is quite possible that an earth wave emanating from the labor of the mountain and traveling for thousands of miles through the solid mass of the crust provided the necessary initial agitation to start the movement of the strata.

Prof. John Milne, the great English seismic authority, has advanced a theory to account for recent disturbances of this character manifested here and abroad in various parts of the world, which has been held tenable by Sir Norman Lockyer and Prof. Archenbold. Prof. Milne declares that the disturbances are due not to a merely normal readjustment of the earth's strata or to the shifting of the surface to meet a gradual contraction in the size of the globe, but are caused by displacement of the globe itself from its true axis and are really due to the jar incident to the subsequent swinging back of the earth upon that true axis. It is conceivable that such a return movement to the axis as well as the original distortion would cause a tremendous strain upon the crust, and could easily account for the most terrific seismic convulsions imaginable. Sir Norman Lockyer declares further that the deviation from the true axis, a fact which, by the way, can be scientifically proven, is due to the great sun spots which at present are sending more energy to the earth than at any other time during the thirty-five years sun-spot period, and which through the great differences in the corresponding temperatures cause the formation of vast ice-masses at one or the other of the poles, of such weight that the distortion takes place, to be subsequently remedied by other variations.

The consideration of the terrible calamity which San Francisco has suffered immediately calls to the mind of the New Yorker the thought of what would happen should a similar disturbance occur on the Atlantic coast. From the experience to be gathered in the present earthquake and from what has been learned on other occasions, it would seem that many of New York's great modern buildings would stand a fair chance of immunity unless the convulsion were one of extraordinary violence, for not only is the great majority of the later structures of the riveted steel-frame type, but the underlying formation, particularly of the island of Manhattan, offers a solid rock foundation of the most substantial nature. Little apprehension need be felt however, for it is generally conceded by authorities on the subject that the city is not in any one of the various earthquake-belts and that this vicinity is part of an area which, considered geologically, is past the formative period by many thousands of years.

### The Death of Prof. Curie.

Prof. Pierre Curie, whose researches on the radioactive elements have earned for him a worldwide reputation, was killed in Paris on April 11 last by a wagon as he crossed the Place Dauphine. His untimely death has terminated a career of unusual scientific brilliancy.

Prof. Curie was the son of a Paris physician and was born in Paris in 1859. He was educated at the Sorbonne and began scientific research on his own account while working as an assistant in the School of Chemistry of Paris. He became a professor in 1895 and at about that time he married Marie Slodowska, a Pole, one of his pupils. She had studied physics and chemistry both in Warsaw and Paris and thereafter shared with her husband the labor and honor of his most difficult experiments. It was she who discovered radium.

She and her husband spent several years in the laboratory of the School of Physics and Chemistry studying uranium and thorium and finally, in 1898, they announced to the Academy of Sciences that they had found a new and strongly radioactive substance in pitchblende. Radium was discovered in 1903. Two years before that the French Academy of Sciences had recognized the work of the Curies by awarding to Curie the La Caze prize of 10,000 francs and commending his wife for her part in the discoveries. In December, 1903, the couple received the Noble prize for chemistry and a few days later they received 60,000 francs as part of the Osiris prize of France—all in recognition of their radium discoveries.

### The Current Supplement.

An article on some German electrically-operated cranes, well illustrated, opens the current SUPPLEMENT, No. 1582. Mr. J. J. Carty, a telephone engineer of authority, writes on how a great telephone system is designed. The article on reservoir, fountain, and stylographic pens is continued. Mr. H. E. Field writes instructively on molding sand. The article by Mr. Alexander G. McAdie on lighting and the electricity of the air is continued. Celluloid and galalith (milk stone) are admirably discussed. Mr. William L. Price contributes a thoughtful review of the possibilities of concrete construction from the standpoint of utility and art. "Surveying on the Farm" is the subject of a well-written account by A. S. Kenyon. Perhaps the most valuable contribution which appears in the current SUPPLEMENT is that by Livingston Wright and Gordon Johnson on "How to Make a Gliding Machine." The article is so thorough and so clearly illustrated, that by following its directions an aeroplane can be easily built. A third installment of valuable alloys is published.

### Automobile Notes.

The Automobile Club of America will conduct a "Two-Gallon" contest on May 5. To the weight of each car loaded 800 pounds will be added, and the product of this figure multiplied by the number of miles run will give approximately the number of pound-miles run per two gallons. The weight of double-cylinder cars will be taken as 75 per cent of their actual weight, and that of single-cylinder cars at 70 per cent. This attempt at handicapping makes it almost certain that a large 4 or 6-cylinder car will win. In fact, upon the pound-mile basis, the large car always makes the most economical showing, as the fuel consumption does not increase in direct proportion with the weight by any means. A $500 cup will be presented to the winner, which will be the car making the most pound-miles per two gallons. The entries close May 2 and a fee of $10 will be charged.

The Grand Prix international automobile race will be held in France on June 26 and 27. This race is to take the place of the Bennett Cup race, which has been held for the past six years. It will be run on two successive days, and the rules which govern it are rigorous, requiring the driver and mechanic to do all the work of changing tires and making necessary repairs. The race will be run over the Sarthe circuit, the total distance being 750 miles.

Canadian mica has been increasing steadily in value from 1895 to the present time, and that of India has been almost as steadily decreasing in value; so that, where in 1895 the imported value of Indian mica was nearly three times that of Canadian mica, in 1904 Canadian mica stood higher than Indian.