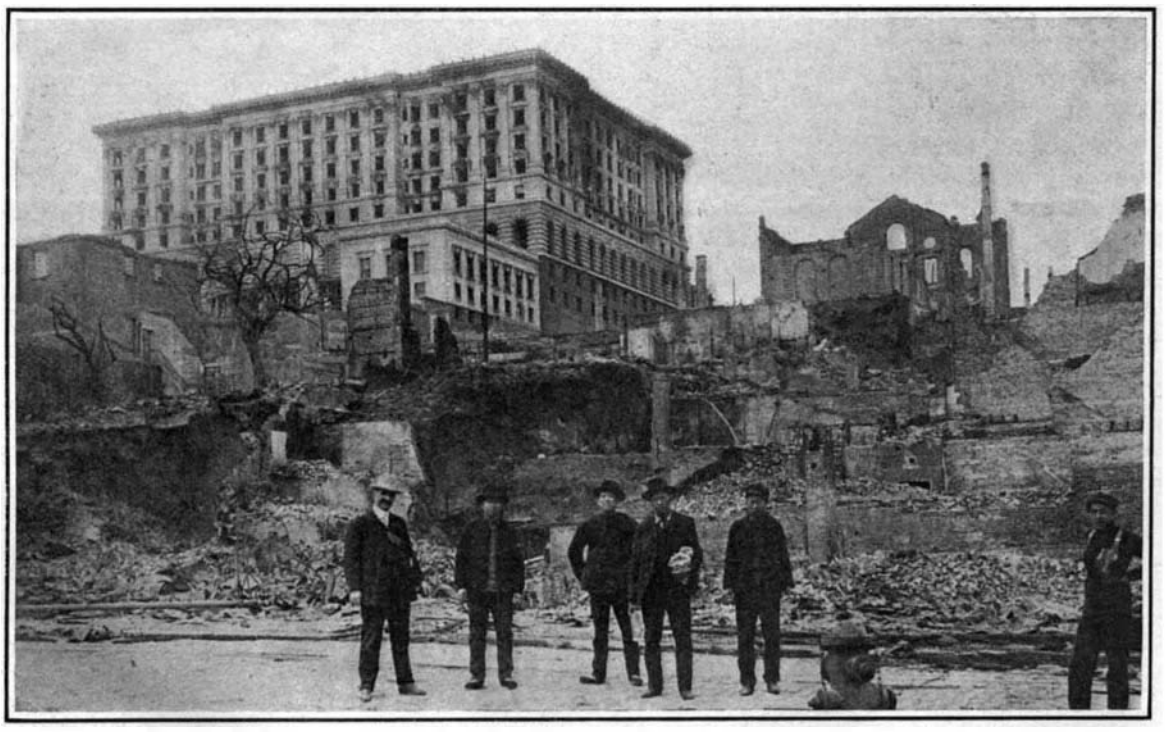
SOME VIEWS AND LESSONS OF THE SAN FRANCISCO DISASTER.

The remarkable set of photographs of the San Francisco disaster, shown on these pages, tell their own story so graphically as to render any comment upon them almost superfluous. The sight of the steel-and-masonry buildings standing, gaunt and fire-stained, but intact as to their structural integrity, amid the leveled ruins of the older buildings, calls up vividly and at once a visit which the writer made to the ruins of Baltimore, while they were yet smoking at the close of the second day of the fire.



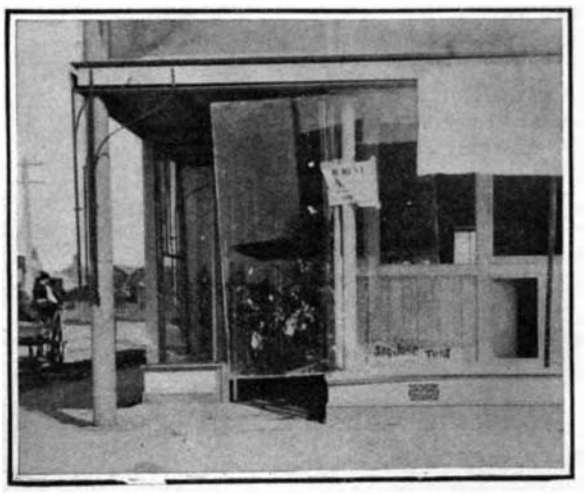
New Fairmount Hotel of Modern Construction Still Standing Amid the Ruins of Older Inflammable Buildings.

The modern steel-skeleton building has abundantly verified the truth of the theories in accordance with which it was built. The engineer and the architect, working together, aimed to produce a building which, by virtue of its enormously strong and highly elastic and well-knit-together steel frame, and the fire-resisting material with which it was floored and clothed in, would be proof against hurricane and conflagration. Incidentally it was hoped, though not confidently predicted, that such a structure would pass through the yet severer ordeal of an earthquake. The Baltimore fire proved the first proposition, and now the San Francisco earthquake has established the truth of the second.

At the present writing, all the evidence at hand goes to show that, in spite of the severity of the shock, the steel frame of the tall office building has come through the ordeal triumphantly. Moreover, in spite of the earlier accounts to the contrary, it now appears (and the accompanying photographs bear out the statement), that the masonry walls, and presumably the fireproof floors, were not shaken loose from the steel framing—not at least, in the tall office and other business buildings. Proof of this, as far as the walls are concerned, is clearly seen in our view showing the Call Building and the new quarters of the Mutual Bank. This fortunate result is to be attributed to the more thorough system of tying the walls to the structure, which characterizes the construction of the latest buildings of this class.

Perhaps the most instructive photograph bearing on this question is the one showing the ruins of the tower and dome of the new City Hall. It will be noticed that the internal steel structure and the metal dome of the tower, even to the figure that crowns its summit, are standing intact, while the two-story circular colonnades, massive though they were, have been almost entirely thrown down. It is probable that the architects trusted to the great thickness and mass of the masonry to give it independent stability, and that it was not very strongly tied into the steel framework. Had the masonry and steel been thoroughly bonded together, we think it is probable that the tower would have been left standing practically intact to-day.

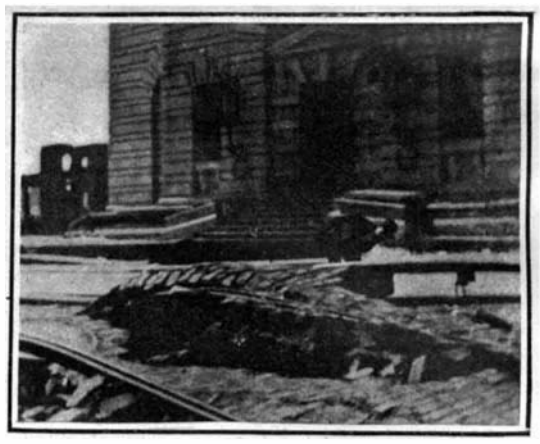
Very impressive is the view showing the great Fairmount Hotel, looking down like a modern Parthenon upon the crumbling ruins which strew the slopes of the hill on which it is built. The earthquake had but little effect upon this costly structure, and what damage it sustained was due to its having been completely swept by the fire. Two of our engravings, those of the Hibernia Savings Society Building and the post office, seem to prove further that a structure which is massively built of cut stone or first-class masonry, if it be of moderate height, can also endure extremely rough usage without any material injury. The damage to the Hibernia Savings Society Building by the earthquake seems to have been slight, and its wrecked appearance is due to its being completely burnt out.



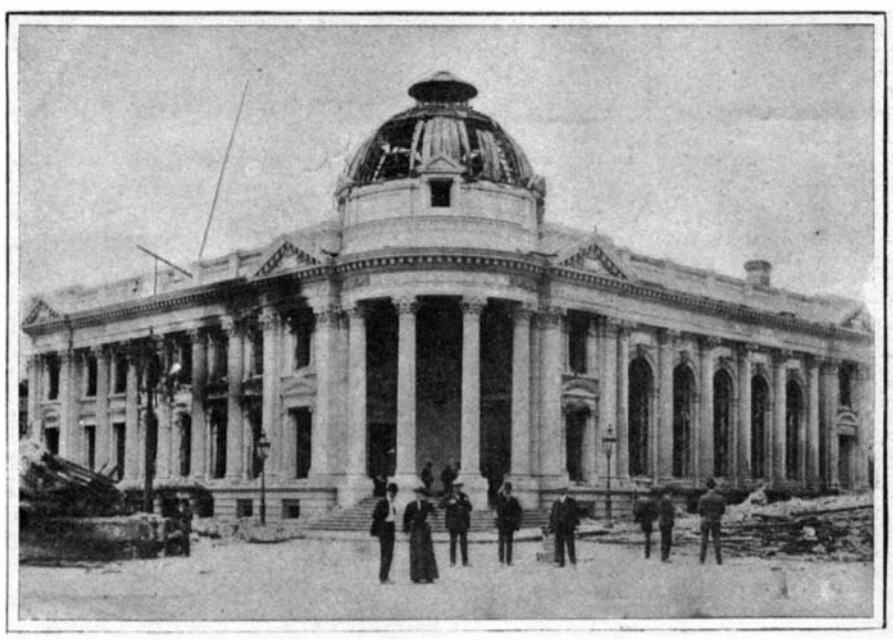
A Window Plate Glass Shifted in Its Frame Unbroken.

The illustration of the post office presents a very remarkable contrast; for while the building itself appears to be in perfect line and level, except in one corner, not shown, which was built over a swamp, the adjoining ground and all parts of the masonry of the building that were not carried by the building foundations proper are greatly upheaved and distorted. How comes it that the building should have stood so unmoved, while the surrounding *terra in-firma* was tossing like the waves of a troubled sea? The paradox is to be explained by the fact that while the sidewalks and streets rested upon either made or filled-in ground, or upon alluvial deposits formed in the ordinary course of nature, the important buildings of San Francisco such as this stood generally upon foundations which reached down to the underlying rock, or to a bearing upon a stratum which in immobility and sustaining power was equivalent to rock. It is possible that when the seismic tremors passed through the earth, there was no great permanent displacement of the rock. But the made ground and the alluvial soil were relatively unstable; and when the underlying rock was shaken, the overlying material was thrown into waves and ripples, much in the same way as the surface of a fluid is agitated if the receptacle that

Crevice and Subsidence of Car Track.



An Upheaval of Street Car Tracks.



Hibernia Bank. Damage to This Building was Mainly by Fire.

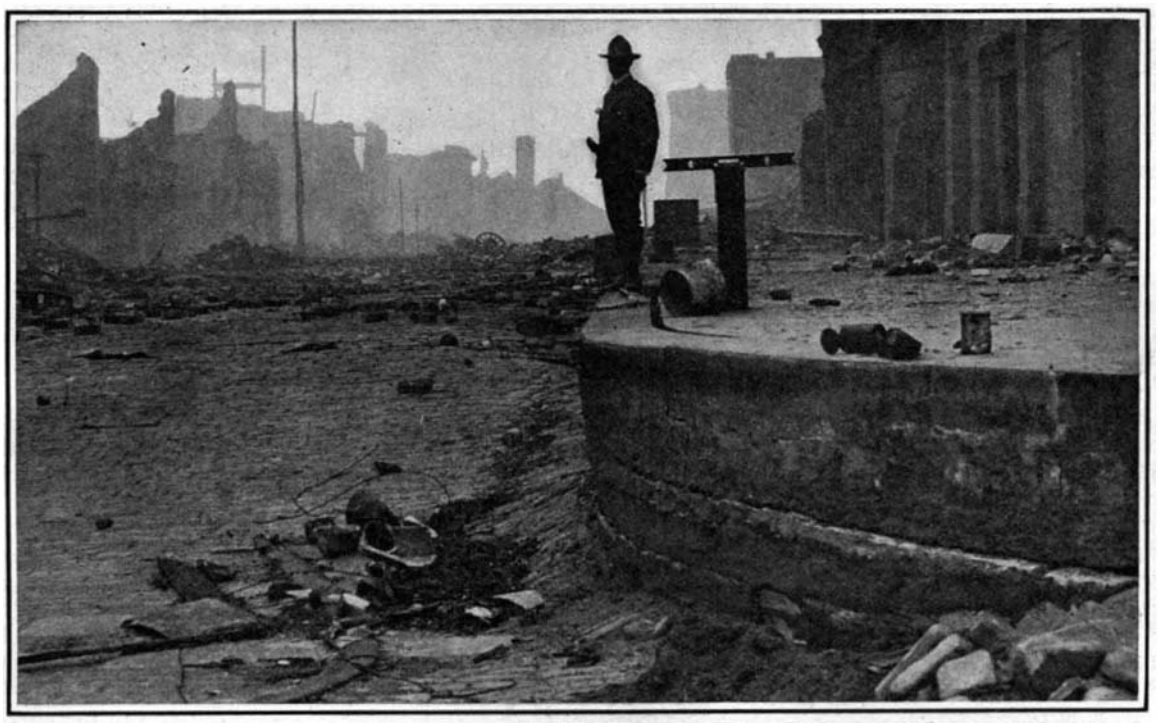
Effect of Earthquake on the City Hall, Showing Steel Frame and Dome Intact; But Masonry Thrown Down.

SOME VIEWS AND LESSONS OF THE SAN FRANCISCO DISASTER.

holds it be shaken with rapid oscillations. When the shaking is over the fluid will resume its normal level; but the loose overlying alluvial material above the underlying rock, not having the fluidity or ease of the readjustment of the water, will permanently retain many of the hollows and billows produced during agitation. An excellent illustration of this action is shown in the sidewalk surrounding the post office, and in the upheaved and depressed tracks pictured in two of our smaller cuts. So also a view taken in Market Street shows that the whole mass of filled-in material of the street has been shaken down some five feet, just as grain or other loose material may be shaken down in a sack or other receptacle.

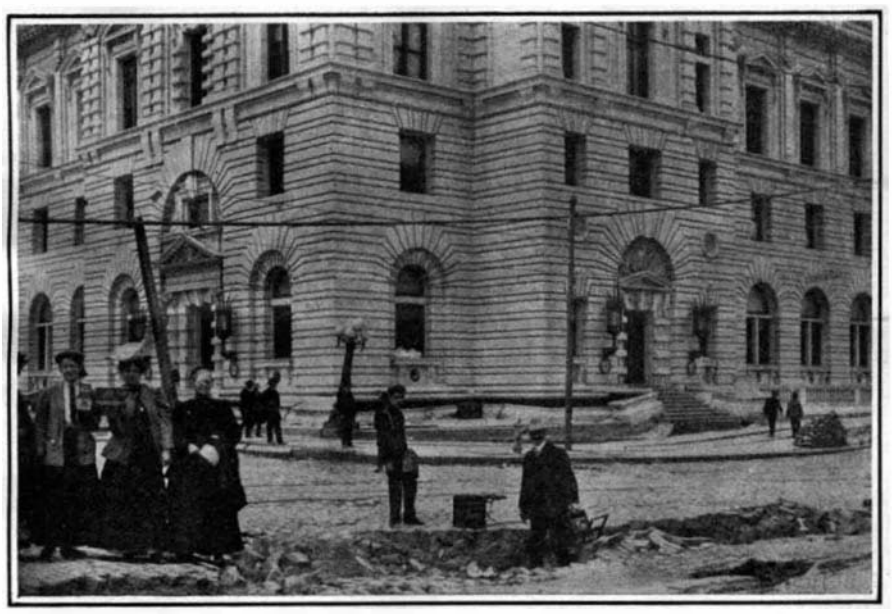
In this connection we may say that we have little doubt that the great length of the flexible wooden piling extending from the base of the tall office buildings in the lower part of San Francisco down to the firmer material, served, because of its elasticity, greatly to cushion and absorb the violence of the oscillations of the underlying rock as they were transmitted through the piling to the steel structure.

After all is said and done, it was undoubtedly the fire and not the earthquake that destroyed San Francisco. This is evident from a study of the photograph taken from the hills back of San Francisco, showing the destruction of the business section. The only visible evidence of the earthquake is the fallen chimneys; the wooden buildings, at least in this section of the city, appearing to be but little harmed. The earthquake did its work in smashing the water mains and cutting off the water supply, and the fire did the rest. Here there is another problem which should receive the most serious consideration of our hydraulic engineers. In the rebuilding of the water mains, the greatest possible use should be made of mild-steel, riveted piping, supplied at frequent intervals with flexible joints. We believe that mains of this character would readily adjust themselves to the twisting and displacement of the ground in which they were laid, most of the adjustment taking place at the joints; while the piping itself would suffer an extraordinary amount of distortion before fracture took place. The following account of the behavior of the various types of construction under the fierce test of the conflagration is from the pen of our special correspondent in San Francisco, who writes us that sufficient was known at that time, Saturday, April 21, of the condition of those buildings which survived the earthquake and the subsequent conflagration, to afford a complete and satisfactory test of the stability of different classes of building material employed in their erection. For once and for all time the popular belief in the incombustibility or slow-burning qualities of redwood lumber was shattered beyond recovery and its use will probably be prohibited, at least in down-town districts, for all future time. The writer remembers distinctly the fire in Chicago and the results, displayed on that occasion, of employing pine lumber in building construction and unhesitatingly pronounces the redwood to be in every way as objectionable as pine in the fierceness of its flame, quickness to ignite, and the intense heat arising from its combustion. In only one particular was the fire in Chicago worse than in San Francisco. In Chicago the wind blew a hundred miles an hour and with such force as to lift whole sections of burning wood which it carried away blocks in advance and ignited wherever it chanced to alight. By this means the fire spread more quickly in Chicago than in the



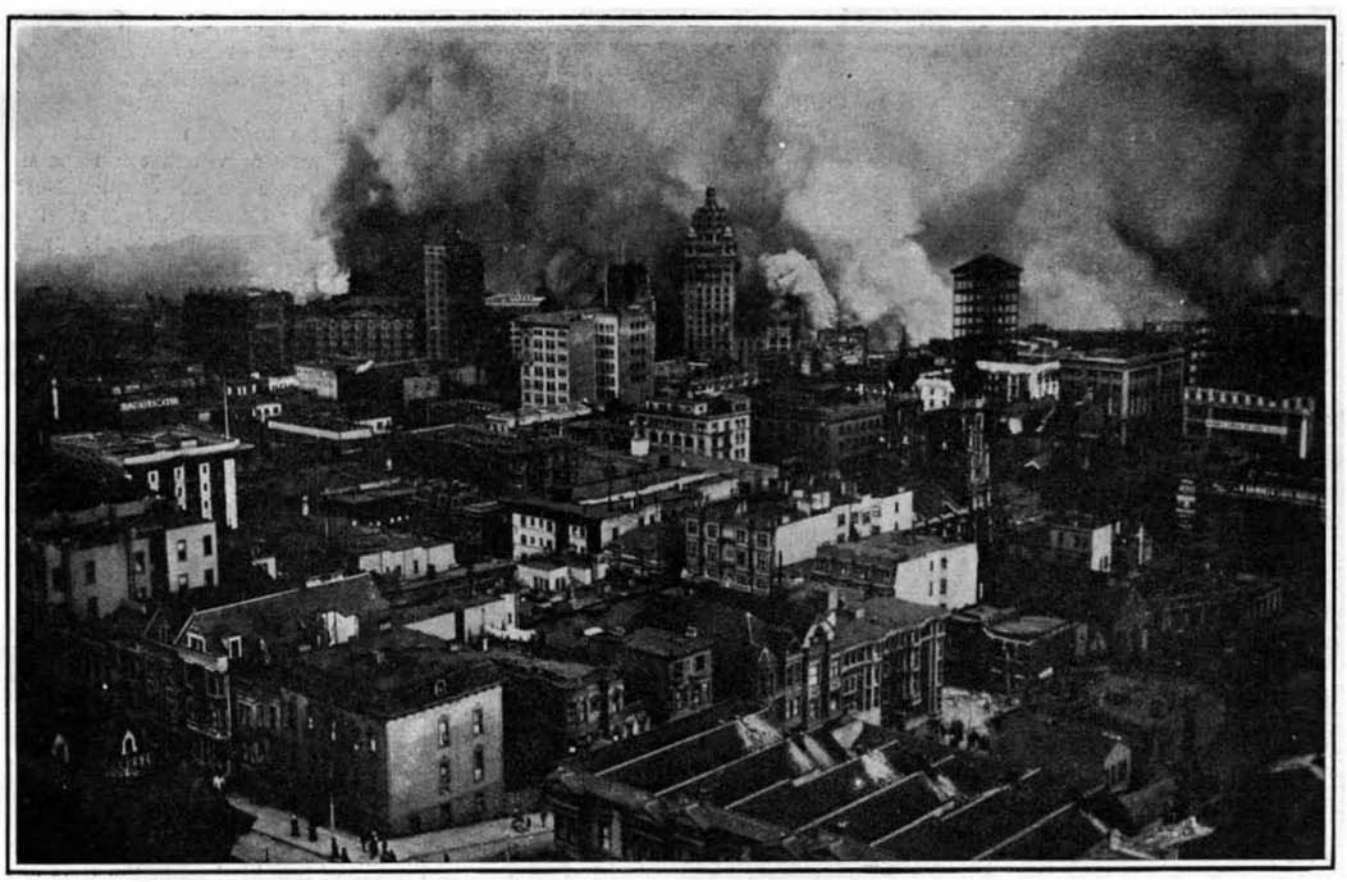
Copyright 1906 by Graham.

Freak of Earthquake. Market Street Sinks Five Feet Below Curb.



The Post Office Suffered Little. Only Sidewalks Are Twisted. Note Fissure in Which Man Stands.

View Showing How Well Steel-and-Masonry Buildings Stood the Test of Earthquake aud Fire.



The Burning of the Business District as Seen from the Hills.

SOME VIEWS AND LESSONS OF THE SAN FRANCISCO DISASTER.

latter city, where its progress was more gradual but not the less certain. Streets a hundred feet wide offered no obstruction to the fire spreading, for the intense heat of the redwood caused the buildings opposite to ignite as soon as the fire gained requisite strength. On Mission Street wood construction predominated, and with this street as an axis the conflagration spread in other directions. Had there been no redwood the business district might have been saved.

Among the more prominent buildings destroyed, taking them in regular order, was the New Merchants' Exchange, finished January 1, 1905, fourteen stories in height and of steel construction, faced with granite on the first floor and with terra-cotta brick for those above. The earthquake caused the building but incidental damage, but fire subsequently gutted it completely. It is now believed that the frame of the structure is intact and can be used again. The terra-cotta is apparently but little injured.

The Union Trust Company's bank, at Market and Montgomery Streets, fifteen stories, lately completed, steel frame, terra-cotta facing, will be occupied for business in a few days, as, the writer is informed, will the Crocker Building, opposite, of like construction, which stands but little injured, apparently only needing new finishing for the inside.

The Palace Hotel was built before the adoption of steel-frame construction, but with solid brick walls which stand and can be made available if desired.

The new Chronicle Building, unfinished, sixteen stories, steel and terra-cotta, will be as good as new with interior furnishings replaced; the old part, however, fifteen years old, steel and brick, is in a precarious condition and will probably have to be demol ished.

The lofty Call Building was subjected to an intense redwood flame, but stands upright and majestic. The Colusa sandstone with which the structure was faced is badly disintegrated by heat, but the frame is said to be intact and may be used again.

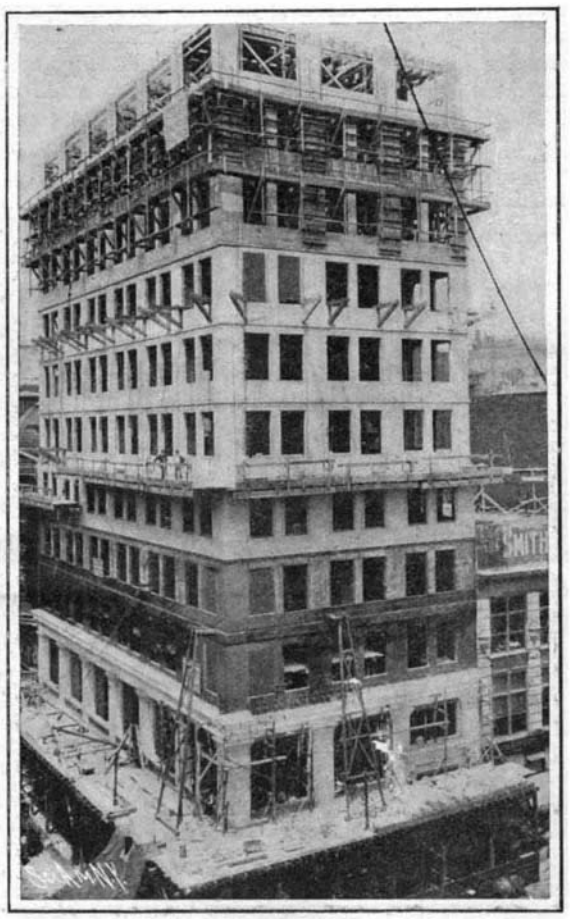
The James L. Flood Building, Market and Powel, just completed at a cost of $2,500,000, was badly gutted, though the steel frame is in perfect condition as far as can be judged. This building was faced with Colusa sandstone, which offered but little protection owing to the intense heat.

The Ahronsen Building at Mission and Third Streets, finished one year ago, ten stories, steel frame, terra-cotta brick faced, with interior replaced will be good as new, though not subjected to the intensest heat, as it was surrounded with low buildings in every direction.

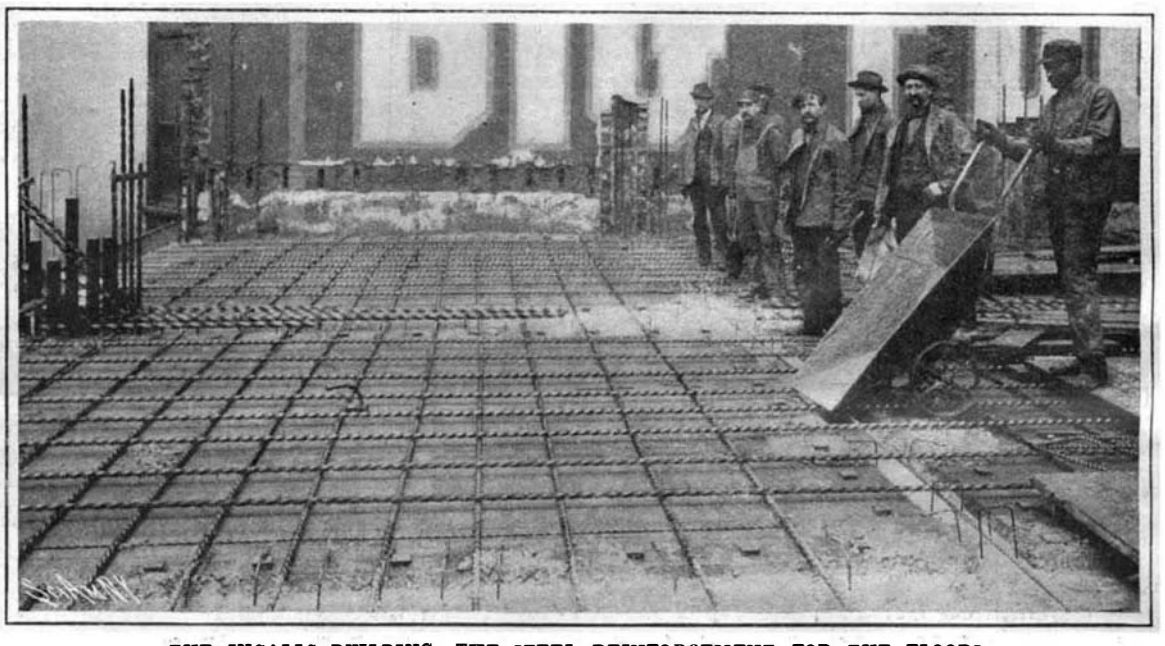
The "Fairmount," of steel and terra-cotta, unfinished, is comparatively little injured, and with interior renovated can soon be occupied.

With these examples it would appear that terra-cotta is far and away the best exterior material for buildings of any height. No stone that was ever quarried can withstand the intense heat of a general conflagration. Though ordinary clay brick of good quality is almost equal in fine-resistance to terra-cotta, as proof against an earthquake shock brick is no better, if as good, as stone.

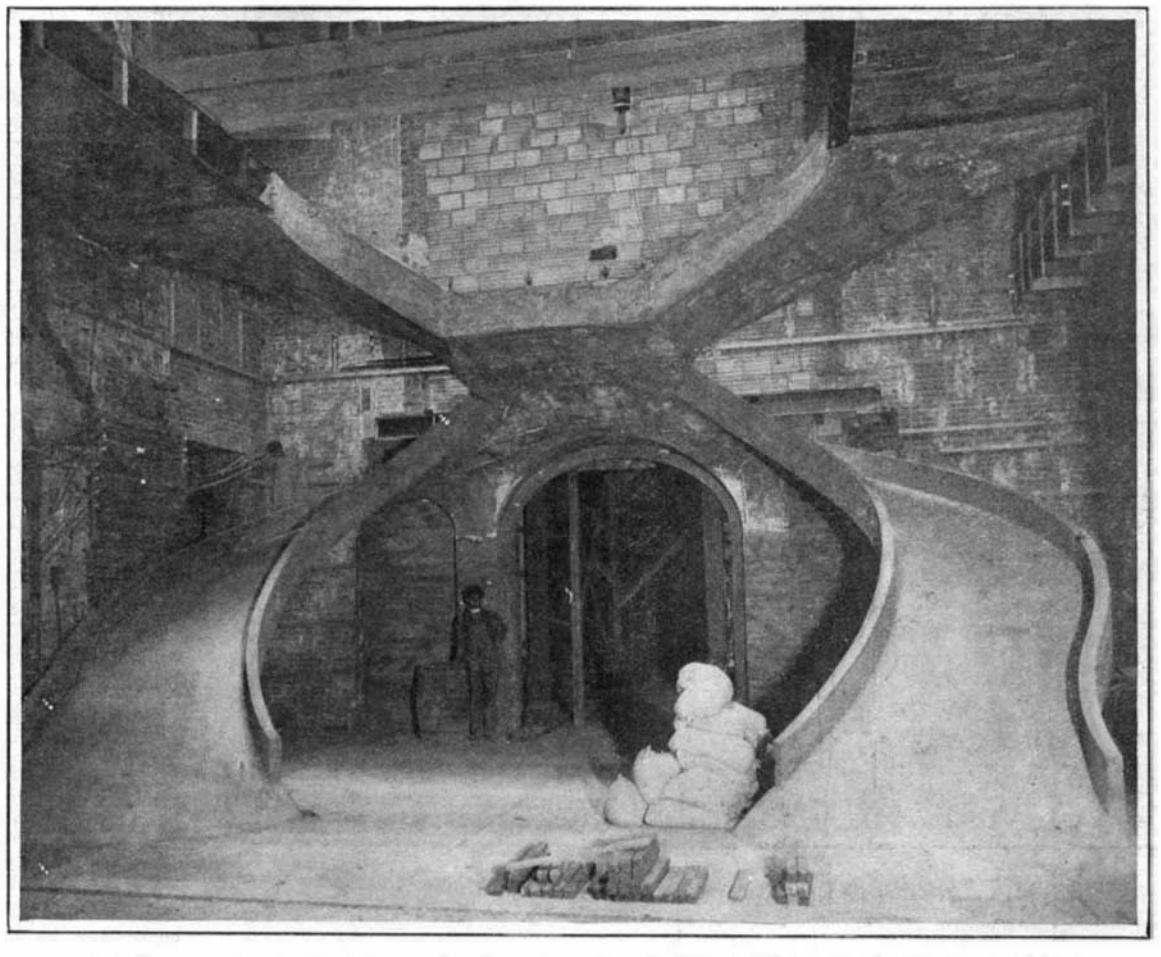
Brick and stone buildings of the past were useless, and as easily demolished in the San Francisco fire as a paper box.



THE INGALLS BUILDING—COMPLETING THE ELEVENTH FLOOR.



THE INGALLS BUILDING—THE STEEL REINFORCEMENT FOR THE FLOORS.



CONCRETE STAIRWAY CONSTRUCTION IN THE NEW YORK HOUSE OF G. W. VANDERBILT.

A STAIRWAY OF REINFORCED CONCRETE.

One of the possibilities of reinforced concrete is interestingly shown in the accompanying illustration from photograph taken during the construction of the main stairway in the New York house of Mr. George W. Vanderbilt. The stairway was designed by Hunt & Hunt, architects, and was built by the Turner Construction Company as sub-contractors. In the engraving the body structure of the stair is shown completed, but without the treads, sides, rails, etc. The stair is double, two branches starting from the ground floor, and rising in graceful reverse curves to meet at a landing somewhat more than half way to the story above. At the point of meeting of the two branches the stair touches the wall toward which the two lower branches curve, and is supported by the wall at the point of contact. Two branches again start from the landing, curving in a direction transversely across the corresponding lower arms to the floor above. The entire stair is supported at only one point between the floors, and that is where it abuts against the wall. All intermediate columns have thus been avoided, for these would not have been in harmony with the design. Had the stair been built of steel, it would have been impossible to obviate the intermediate supports except by making the structure exceedingly heavy and bulky, a feature which would have been objectionable.

The construction is on the Ransome system, in which the concrete is reinforced by longitudinal and transverse bars of twisted steel carried into the supports where necessary, and with the individual members, where possible, tied together by wire. The longitudinal bars, both in the body and the sides, are bent to conform to the curvature of the stair, and are continuous from the intermediate landing to the floor above and the floor below. The transverse rods are spaced short distances apart, and have their ends bent at right angles to project into the lateral flanges, clearly shown in the photograph. The concrete construction is carried out to engage with the I beams in the wall and at the second floor landing, and thus is formed an extremely solid bond. The design is not considered by engineers a difficult one to execute, notwithstanding that the result is rather a freak structure. It merely proves that it is possible to build anything of concrete for which a mold can be constructed and set up, and that with the steel reinforcement the resulting structure is not only strong, and solid, but is often less cumbersome than a corresponding one built entirely of metal. In the present case, if the stair had been built of steel, it would have been necessary to design and manufacture each piece separately, with a consequent loss of time and at greatly increased expense.

The stair is designed for a live load of about 150 pounds per square foot, and was found to answer all requirements in a thorough series of tests, in which heavy bags of cement were dropped upon it at various points from a height of some 12 feet. The stairway was finished in white marble with brass railings, and the structure has turned out to be not only a pre-eminently practical one, but an extremely handsome piece of work as well.

THE INGALLS BUILDING — THE LARGEST CONCRETE OFFICE BUILDING IN THE WORLD.

Among the earlier large concrete buildings in this country is the Ingalls Building, of Cincinnati, designed for office, banking, and telephone exchange purposes, and undoubtedly the most ambitious structure of this kind up to the time of its construction. It was begun on October 2, 1902, and completed late in the following year. It has sixteen stories, a basement, a sub-basement, and an attic, measures 100 x 50½ feet, and rises to a height of 210 feet from the sidewalk