THE APPROACH OF THE CEMENT AGE

A NOVEL type of building construction as applied to that class of structures adapted to house great assemblies of people and especially to safeguard school children and their teachers against constant peril from both fire and panic, is described in the fireproofing number of Cement Age, New York.

The central idea embodied in the plan presented for school buildings, is to form, centrally, within the walls of the building structure, a fireproof place of refuge, which shall be instantly available through fire doors within its walls connecting directly with every floor and its series of rooms, and which shall have sufficient capacity to temporarily house and safeguard all the occupants of the building and from which by ample stairways they can leisurely wend their way to the outer air through a protected causeway in the basement, unhampered by fire, smoke, or even undue heat.

While the saving of human life is the primary object of this novel feature in building construction, a secondary object of great significance to fire departments and to the public generally, is the ready access afforded and the means employed for fighting the fire centrally, and at close range, without in the least imperiling the lives of the firemen.

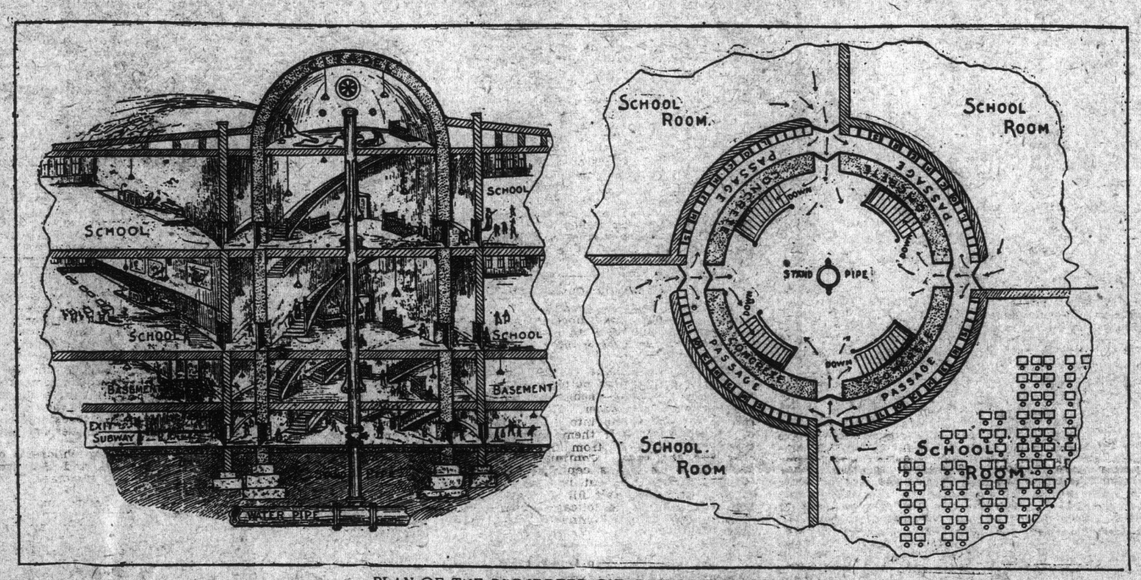
A third feature of much incidental value lies in the direct access which the citadel gives to every room in the building, and their interconnections, and especially its value as a means of ingress and egress of the pupils, without in the least disturbing the occupants or recitations in any of the other rooms in the building.

The citadel proper, save for numerous fire-doors connecting with each floor and basement causeway, is a closed and independent structure resting on its own foundations and extending from basement to roof, which is capped and fireproofed, presenting no opening save for firemen's use and for artificial ventilation.

It is provided with floors inter-connected by stairways, which floors are coincident with those of the building proper, and are rigidly secured to the inner walls of the citadel.

This citadel, in structure, may be of brick or reinforced concrete and may be of any desired prism and of dimensions suitable for any special requirement. Being a closed structure and absolutely fireproof, no fire can originate within its walls, nor can fire and smoke enter from without, as no draft can be created in either direction, except voluntarily through artificial means. However, under normal conditions an electric fan or blower in the dome of the roof, will serve for purposes of ventilation.

The intermediate space between the walls of the citadel and the outer building serves the purpose of continuous connection of every school room with all the fire doors, while the space is aptly located for lockers, cloak-rooms, closets, etc.



PLAN OF THE PROJECTED CITADEL OF REFUGE

Arrangement of citadel in relation to school rooms, with subway exits. Cross section showing standpipe stairways, concrete fireproof walls and outside passage ways

Expert Tells Why Concrete is the Best Fireproofing Material

A great many experiments with structural materials have been conducted under the auspices of the U. S. Geological Survey at the St. Louis laboratories by Richard L. Humphrey, expert in charge. In an interview upon the fireproof qualities of concrete, which appears in the fireproofing number of Cement Age, New York, Mr. Humphrey made the following statement based upon observation and experiments with concrete: "Concerning the merits of concrete as a fireproofing material, there have been many fallacious opinions advanced in current literature, and it is apparent that the conclusions of many of the writers are not based upon experience, but rather upon hearsay information. The requisites of a first class fireproof material are as follows: First, that it shall be plastic—for in that condition it can be readily applied either as a structural material or as a protective coating to other structural materials. Second, that it shall be a poor conductor of heat in order to afford the highest degree of insulation. Concrete fulfils these conditions admirably; better than any other material at present available for fireproofing purposes. While it is true that the water of crystallization of cement is driven off under a prolonged and high temperature, yet the rate of this action is extremely slow, and it takes a fire of very considerable intensity and duration to injure the concrete to a depth of more than a quarter of an inch. The surface of concrete thus damaged can be readily repaired by plastering with cement mortar and the stucture will then be in the same condition as before the fire. Where concrete is used as a structural material it is necessary to apply additional thickness to serve as a fireproof coating to protect the structural concrete from damage. The strength of the structural concrete thus protected is not damaged by the most severe conflagration, while the fireproof coating, which may be damaged to some extent, can be readily renewed at a minimum cost. The low rate of conductivity is particularly desirable in a material for fireproofing steel, since an adequate coating will prevent the structural steel from becoming heated beyond the danger point even in the most severe conflagration. Many other forms of fireproof fail and become valueless under comparatively low temperature and, worst of all, leave the structural members at the mercy of the flames, as the abundant evidence of the Baltimore and San Francisco fires will show."

Unsuccessful Attempts to Discredit Concrete

The rapid strides made by concrete as a building medium have alarmed the manufacturers of competitive products, says Cement Age, New York. Even wage earners in the older trades are concerned lest there should be a serious decline in the industries through which they gain a livelihood. The result has been concerted effort to discredit concrete. Attempts are being made to influence municipal legislation against concrete by the enactment of ordinances designed to seriously restrict if not prohibit its use. Opposition has been so extreme in some localities that anonymous circulars declaring concrete construction to be unsafe have been sent to bankers and real estate brokers to restrain them from lending money for building operations in concrete. Here and there bureaus have been established whose agents give the widest publicity to every concrete failure, ascribing it to the material. But in every one of these cases, which, by the way, have been exceedingly few, considering the fact that the industry is still in its infancy, it has been shown that failure had occurred through carelessness, incompetency or poor workmanship. So flagrant was the disregard of specifications in most instances that criminal prosecutions followed. Notwithstanding the great outcry made whenever a collapse occurred, the leading engineers of the country are using concrete in vast quantities in great enterprises calling for the most durable workmanship and huge dams, bridges and factory buildings are being constructed in all sections of the country. No record of collapse can be found where engineering ability was in command, and the opponents of concrete have found ammunition to be exceedingly scarce. While they were using to the best advantage the few concrete failures growing out of bad workmanship, the great steel bridge at Quebec went down with a crash that resounded throughout the world, dragging with it the reputations of men who had achieved international distinction as master builders with a material not new and untried, but one upon which science had labored for generations. The collapse still reverberates in the engineering press and before courts of inquiry. It is significant to note in this connection that plans now under way for the world's greatest bridge—the Henry Hudson Memorial bridge, at New York—call for concrete. The huge central arch will be a mammoth affair resembling something nature-wrought rather than the handiwork of man, a span so high and long that sea-going ships passing underneath will appear as small craft. So strong and massive will be this monolithic mass that mechanical engines whose dimensions we measure in tons will become practically a negligible quantity so far as weight and vibration are concerned.

What Constitutes a Fireproof Building

A building to be fireproof in the true sense must be able to resist the application of water during the progress of a fire, is the statement made in the fireproofing number of Cement Age, New York. This is a factor perfectly understood by engineers and experts but frequently overlooked by the layman. The iron or steel columns supporting a many-storied structure may be encased with a material, terra-cotta, for instance, which will stand the most severe ordeal of the laboratory furnace, but which, when hot, will disintegrate and fall away if drenched with water, thus exposing steel and iron to the flames, ultimately causing their destruction and the collapse of the entire structure. That is why modern engineering science defines the fireproof building as a structure not only capable of resisting fire, but one in which the supporting members are protected by a fireproof covering capable of withstanding the application of water when intensely hot. Therefore, to be really fireproof, as the term is used in this day, every part of a building must not only be of non-combustible material, but every vital member must be protected by an outer covering of the character described. It is of the highest importance that there should be fireproof doors and windows to prevent the spread of flames through various apartments. Indeed, the modern trend of endeavor in seeking to establish absolutely safe conditions is more in the direction of preventing the spread of fire than devising means to subdue it. The natural inference would be that fireproof construction means a vast outlay of money over and above what is now expended. Fortunately this is not the case, but even at largely increased first cost such a reform would mean economy in the end. Over a half-million dollars was lost in a few hours in New Orleans the other day. This money expended in fireproof construction of the type described would have been a good investment.

How the Fireproof Qualities of Concrete Were Determined

The attempts by the advocates of concrete to demonstrate its fireproof qualities were not all plain sailing for those who had confidence in its ultimate triumph as a structural material. The fireproof problem was a serious matter. The most natural and direct method to pursue was to bring concrete in contact with fire to see what would happen, and the most convenient way to demonstrate this, and at the same time afford comparison with other materials, was to mold it into cubes and subject it to the heat of the laboratory furnace. These tests showed that concrete would disintegrate under conditions from which burned clay and terra cotta were withdrawn intact is the statement made in the fireproofing number of Cement Age, New York. It was a disappointment to enthusiasts on the subject of concrete construction so far as its use in building construction was involved. The man of the hour appeared in the person of Professor Ira H. Woolson, of Columbia University, a scientist of note. Before a scientific body a year ago, Professor Woolson read a paper dealing with the low thermal conductivity of concrete which, in plain terms, means that it requires a long time for heat to penetrate concrete. His experiments upset the conclusions of the opponents of concrete and revived the enthusiasm of its advocates. The extreme importance of the announcement made by Professor Woolson was scarcely realized at the time. What it really meant may be made clear when it is stated that while a small concrete cube may disintegrate in the laboratory furnace when entirely surrounded with heat, a concrete block or thick coating of cement may be subjected to a fire of 1,700 degrees F. for two hours, and remain comparatively cool on the side not exposed to fire. This also means that the application of water is followed by a mere surface disintregation. Thus it was suddenly realized that here, after all, was the ideal, the perfect fireproof material. It meant a protection to columns which would be maintained for hours under stress of both fire and water; at least a sufficient length of time for the ordinary fire to burn out before the concrete would become heated throughout. It also meant extreme economy in the application of fireproofing as to first cost. It means conservation of space in column construction and cheap and quick restoration of the fireproof coating in case of surface disintegration. Professor Woolson's conclusions were further corroborated in the San Francisco fire, but it should be remembered that in both these fires there were no true concrete buildings as the term is accepted today. But since then both laboratory tests and actual fires have sustained the conclusions presented by Professor Woolson. At the St. Louis laboratories conducted under the supervision of the United States Geological Survey, tests of concrete specimens were made by Richard L. Humphrey, expert in charge, in which the concrete was subjected to a heat of 1,700 degrees F. for two hours, followed by the application of water. Paper labels on the backs of these specimens were not even scorched and one could touch the concrete without burning the hands. Slow heat conductivity, then, is the great virtue of concrete as a fireproofing agent.

The Importance of Fireproof Partitions

If a fire—no matter how intense—can be confined to one room long enough for the firemen to reach it with their apparatus, the chances of a serious financial loss or danger to life are extremely small, says Professor Ira H. Woolson, of Columbia University, in the fireproofing number of Cement Age, New York. Even though the fire be started on one of the upper floors of a high building, the danger of spread is limited if the partitions remain intact, for the firemen can fight it from the same floor level. On the other hand, if the partitions are of the flimsy character very often permitted to be used in such buildings, a hot fire on one side possibly aided by a stream of water thrown through a street window, quickly becomes general over the floor. The danger is then great. The firemen cannot operate on that floor and the chances are that the floors above must be left entirely at the mercy of the hazard of ignition from street windows, or from defective protection at the elevator shaft, or other necessary floor openings. If the fire happens to be several stories up, the difficulty of fighting it from the street or adjoining buildings is increased. It is well known that in a very large number of our so-called fireproof buildings, constructed during the past twenty years, the menace from this kind of a fire is imminent. It is the rankest kind of folly to put carefully constructed fire-resisting floors in a building, and then allow the use of partitions that are fireproof in name only, or at least will offer only small resistance. If a whole floor of a large building burns out the chances of saving the floors above are small even with the most approved opening protection, and the hazard of the whole building is great. The question is frequently asked if a strictly fireproof partition can be built which will be comparatively inexpensive and not exceed three or four inches in thickness. My answer is emphatically, Yes. I have the proof of my positiveness in the end walls and roof of one of my fire test buildings at Columbia University, which has been used for testing partitions about thee years. It has four large chimney flues—one in each corner of the flat roof, and is supplied with draft openings at the bottom and a grate floor upon which the fire is built. The building has a steel frame and the side walls are removable. They are built for each test and are constructed of the partition-material under investigation. These test partitions are therefore 10 feet by 14 feet in size and constitute the temporary side walls. A test for such partitions consists in building a dry cordwood fire on the grate and bringing the temperature gradually up to 1,700 degrees F. for half an hour, then maintaining an average temperature in the building of 1,700 degrees F for half an hour longer, after which a stream of water under 30 lbs. pressure is applied to the walls through a 1⅛-inch nozzle for five minutes. During the time this building has been in use ten 1-hour tests have been made, and one 2-hour test, or an equivalent of 11 hours of fire, half of which time the temperature has averaged above 1,700 degrees F, and the water has been applied at the end of each test as described. During all that time the end walls and roof of the building which are of concrete have never been removed or repaired, except occasional patches of the surface have been given a light coat of cement plaster where roughened by the force of the water. The walls are four inches thick and the roof five inches. They are still in most excellent condition, and apparently able to withstand a large number of similar tests.

The Development of Concrete Construction

The discovery that some of the world's most ancient and imposing structures are concrete is an old story. The fact that they have remained intact through centuries of time led to the revival, and in some countries the birth of the cement industry, says Cement Age, New York. Not long after the cement manufacturers and builders of Europe mastered the fundamental principles involved in the successful making and use of cement, American enterprise began to experiment in the same field with the result that the Portland cement made in this country today equals the best produced abroad, and, in the matter of output, exceeds foreign production to the degree that we have become by vast odds the greatest cement producing country on the globe. Fifteen years ago any one of the large municipal improvements recently made in New York City would have consumed the entire output. In this day if a half-barrel of cement were presented to every inhabitant of the United States there would still remain a sufficient quantity to build a 4-foot concrete pavement around the earth. American engineers were quick to discover the manifold advantages of cement. They found that it rendered comparatively easy engineering achievements that would have been extremely difficult and costly without the aid of cement—in many cases practically impossible.

Fireproof Building of Brick Impracticable

In the reports of recent great conflagrations such as overwhelmed Baltimore and San Francisco, and in the investigations of detached fires, it is found that brick is an excellent fireproof material, says a writer in the fireproofing number of Cement Age, New York. If it were practicable to construct a building with walls, floors, partitions and roof of brick, and with weight-carrying members encased in courses of brick laid in cement mortar, the result would possibly be a fireproof structure. It is not practicable, however, for reasons that are manifest. In the first place the cost would be excessive. The use of brick in certain construction means loss of floor space. In the walls it means loss of light. In brief, it is both cumbersome and costly as a structural material to use brick. A substitute possessing all its virtues as a fireproof material and quite as durable, is found in concrete. Concrete means conservation of space, increased lighting facilities, low cost, absolute resistance to fire and water, rapid construction, which in turn means economy for labor as well as material; great rigidity and the ability to withstand earthquake as well as fire. It is adaptable for foundations, walls, floors, columns, girders, beams, roofs, doors, window frames and stairways. From the foundation to the peak of roof or top of tall chimney, a building may be constructed entirely of concrete.

THE ADVENTURES OF A GOLD COIN

As a work of art, a miniature medallion in high relief, the St. Gaudens' $20 gold coin is extremely beautiful, but in its first state, after less than eight thousand of them had been struck off, there never was a coin since the days of Pompey and Sextus so impracticable for general circulation as this thick, unwieldly disc of gold.

Whether intentional or not, a quantity of these twenty-dollar curios got into active use, and Wall Street, ever on the qui vive for a sensation and a chance to turn it into profit, promptly sent the face value of the new coin soaring premium-ward with a story that in making the Roosevelt-St. Gaudens' double-eagles thirty dollars' worth of gold had been run into them. Despite the instant denial of the United States Treasury officials the story that the foot of the workman who ladled out the gold for the new coin had slipped at the critical moment of casting, making him pour an excess of the precious metal into the crucible, spread up and down the Street and agitated the Curb Market in a way that was strange to see. From twenty-two to twenty-eight to thirty dollars the double eagles soared. Coin collectors, too, bought up hundreds of the new pieces, and today the original issue is about as scarce as the silver dollar of 1836, known as the Gobrecht piece, which now brings a standard premium of fifteen dollars. That the St. Gaudens' coin could not be stacked up in piles by cashiers and paying-tellers; that it lacked flat edges and was not milled, but inscribed with raised letters around the rim; that it was weightier than any of our other gold coins, was certainly not the fault of the noted American sculptor who designed it.

The next issue of this much-discussed double eagle will doubtless be more carefully and properly made. It will stack as easily as it will spend, and we shall then have at least one coin of the realm that is good money and good art. The thousands who have written to President Roosevelt urging him to put an end to the further coinage of the latest gold pieces, or at least to restore the phrase, "In God We Trust," do not know that the President has no power now to abandon the new design even though he should strongly desire to do so. Once a coin has been approved and its issuance ordered, it cannot be changed for a period of twenty-five years except by a special act of Congress. This is the state of things today. The St. Gaudens' coins will continue in circulation for the next quarter century, unless Congress orders the use of other designs.—From "The Coin of the Realm," by Perriton Maxwell, in The Bohemian Magazine for July.