present buildings and their contents fireproof—we agree, of course, that the term is only relative, nothing is absolutely fireproof—and what are the details in which the risk is deficient and may be improved, so that buildings and contents may be made more nearly proof against loss by fire. There are two distinct types of fireproof buildings, each with some variations and some combinations of the two.

HOLLOW TILE.

You are familiar with the type of steel frame tile floored building so common in this immediate neighborhood. Its main supporting frame is of steel members riveted together, and this frame supports the walls of brick, terra cotta or stone and supports also the floors and roof of hollow tile or concrete, the latter reinforced by some sort of patented metal meshed bars or wire. Its interior walls are generally of hollow tile 4 to 6 inches thick, and generally containing more or less wood and glass doors and windows.

In addition to forming the floors, roof and interior partitions, this hollow tile is also arranged to form a complete insulation or envelope about the structural steel frame, the thickness of material about the steel usually varying under the present practice from 1 to 4 inches—not 4 inches of solid material, of course, but a block 4 inches in total thickness including the hollow space. This insulation is provided chiefly by the floor blocks themselves, but supplemented by additional pieces for no other purpose than insulation alone.

There are two types of floor arches, known as end construction and side construction, the former being considered preferable. The difference in the two systems is that in the so-called end construction all the webs of the block run transverse to the beams, and, therefore, form a continuous run of material from beam to beam, while in the side construction the webs of the blocks run parallel with the beams, and, therefore, only one-half of the webs are in direct compression—that is, in a line from beam to beam. In the usual flat arch construction the end style proves the stronger.

The greatest weakness of this tile construction lies in the fact that the individual pieces of tile are in hollow form and have no elasticity, but at the same time having the quality of expanding under heat they crack and break apart when one side is subjected to heat. This is usually most apparent on the underside of floor blocks, as you have doubtless seen in photographs of such buildings after a fire. It used to be supposed that this breaking was due to expansion of steam or gases generated inside the blocks. That theory, however, has long since been abandoned and the unequal expansion idea accepted as the explanation. Another weakness is in the large-sized units of the tile which, together with the thin shell, generally not over 1 inch, makes it difficult to get a good mortar bond between the different pieces, so much so that various forms of metal clips or binders are frequently employed to help in holding the tile in place, particularly about the columns and large girders where the floor arch itself does not lend any stability or support to the insulating portions.

I do not mean to emphasize these weaknesses as condemning the tile construction severely. They are most apparent under rather unusually hot or long sustained fires such as the conflagrations in Baltimore and San Francisco. The trouble may be seen in almost any fire of ordinary severity, and you may to-day see a little of the effect if you will walk down Broadway and look through the windows of the Equitable building.

In other respects than the steel frame and hollow tile, a building of this type is not radically different from any other large substantial structure, that is, its trim, decorations, fixtures, etc., are practically the same. Most of them have wood finished floors which, of course, contribute some little additional fuel in case of fire.

REINFORCED CONCRETE.

There are some very interesting features of reinforced concrete quite different from the type we have just been discussing. The entire walls, floors, columns and roof are of a single monolithic mass of concrete strengthened or reinforced by some style of steel rods or bars, such as the Ransome system with its twisted bars, the Kahn system with its so-called trussed bar, etc.

In all these systems of reinforcement the steel—of whatever shape—is designed to carry practically all the tensile strain while the concrete takes up the compression. As a matter of fact, the tensile strength of concrete is considerable, but is so small in proportion to the compressive strength (1 to 6 or 8) that it is ignored in designing. This, of course, necessitates placing the steel members as near as possible to the lower surface of beams and girders and the outside of columns. It is evident then that, with steel occupying such an important position in the structure, it must be thoroughly protected against heat if the building is to be fireproof—just as essential, in fact, as the protection of the steel frame of any other sort of building.

The relative value of these various styles of reinforcement from a structural point of view regardless of fire resistance is still a matter of dispute between engineers, and there is also still some difference of opinion as to the proper ingredients and method of mixture of concrete, though the latter question has now about come down to a division as between cinder concrete, as advocated by a limited number of designers, and almost any sort of stone concrete, as preferred by the large majority.

SUPERVISION OF CONSTRUCTION.

The ideal concrete for building construction above the foundations is a mixture containing a little more than enough Portland cement of standard quality to completely fill all the voids in the sand, and enough of this sand and cement mixture to a little more than fill the voids in the stone, the whole to be tamped down to a solid mass. It is not commonly practicable to follow this formula exactly on account of the difficulty of getting stone and sand of uniform size or of evenly graded sizes, and of accurately measuring them on new buildings. On important contracts where machine mixers are used and the construction is under the superintendence of competent architects, the variation from this rule need not be very serious. However, there is no doubt that in many cases in the past, where expert superintendence has been lacking, contractors and their employes have wilfully or ignorantly used concrete containing much less than the proper quantity of cement and hurried the mixing so that the result has been a construction neither sufficiently strong nor fireproof. The nature of the