METHODS OF RAPID CONSTRUCTION.

IN the Engineering Magazine for February there is an article by Mr. Francis H. Kimball, who, with Mr. G. K. Thompson, designed and superintended the construction of the Manhattan Life Insurance Building—one of the loftiest of the new American class of structures, or sky-scrapers—descriptive of the mode employed in completing it within a brief time. Mr. Kimball writes :—

The temptation to excel some other record in the quick-building line, together with a desire for quick returns from rentals, losing but one season, is more than the investor can withstand. The architect has no choice in the matter ; he must accept the inevitable, and bring to bear all his skill to accomplish the end desired in the best and most workmanlike manner.

It is not difficult, at the close of one of these quick-building operations, to trace the reasons which led to so successful a termination.

The most recent example in point of the actual time consumed in erection and in finishing the great bulk of the building —which has not been equalled up to the present time, pound for pound of iron and brick for brick of masonry—is the Manhattan Life Insurance Building, with which the writer is identified.

No comparison can be made between New York and Chicago records, as our building laws are more rigid, in that they exact a greater degree of stability in the structural features.

In the case of the Manhattan Life Building, the time consumed in its erection may be divided into two parts, as follows : —Foundations ready for superstructure, five and two-thirds months ; superstructure, eight months.. The roof or eighteenth tier of beams was reached in exactly three months from the time when the foundations were ready, on which to set the first piece of steel composing the bolsters that support the cantilever system.

The time spent in preparing the foundations may seem to those unfamiliar with this work scarcely consistent with the progress afterwards made, but the architects found that, in view of the unsatisfactory nature of the ground composed largely of quicksand, the usual methods employed, such as piling of masonry, were inadequate for the purpose of a foundation to sustain the great concentrated loads, and they thereupon decided to reach bed-rock, 57 feet below Broadway, by some unprecedented means. They finally concluded to introduce the pneumatic process used in sinking bridge piers to rock.

Sinking the piers to bed-rock rendered the building independent of any outside operations, either building foundations or tunnels. The fact that they were the pioneers in this undertaking, so far as the application of this principle to building work is concerned, led to much carefulness on the part of the engineers, Messrs. Sooysmith & Co., in respect to the probable effect on the foundations of adjacent buildings, and that there might be no disturbance of such foundations, by reason of going so far below them, no attempt was made to force work to the degree attained in bridge-work where operations are carried on in an open country.

The magnitude of the work may be better understood by reducing it to cubic yards of masonry. This substructure, which starts on bed-rock and continues up to the level of the cellar floor, consists of fifteen piers, varying in size from 9 feet in diameter to 21 feet 6 inches by 25 feet square. The caissons made of steel corresponded in size to the piers they sustain, and were 11 feet in height. These caissons were filled with concrete, and contained altogether 1,260 cubic yards. The number of bricks used in the piers amounted to 1,500,000.

From this it may be seen that a good-sized building was sunk out of sight before any part of the superstructure could be begun.

The fact that a new method, with more or less experimental work attending its adoption, had to be devised, and the really large mass of masonry forming the piers, are sufficient excuses for the length of time consumed in this feature of the building. It was a work which in olden times might have taken twelve months. Even the progress attained was due to the fact that three relays, or gangs, of men were employed in sinking the caissons, thus giving the work the benefit of the full twenty-four hours in one day for the entire period of five and two-thirds months, except in the case of the masons, who worked only regular hours.

Suffice it to say that in three months about 5,800 tons of steel were raised into position. This was not accomplished, however, without night work. When the foundation work was prolonged to September 1, the prospect of completing the building on May 1 was not promising. A council was held—attended by the building committee, architects and builders—the purpose of which was to incite the builders to greater activity and also to settle upon a plan for beginning and continuing night work until the roof was reached.

This meeting resulted in the institution of day and night gangs of men for the erection of the steel frame ; and by reason of the time which, in consequence of the delay in the foundations, the contractors for this branch of work obtained for the making of the wrought material and the delivering of the same within a short haul of the building, coupled with the fact that great care was taken at the rolling mills in laying out the various members to templates, so that when they were assembled at the building no fitting was required, the work of erection went on without interruption from the beginning to the end. Recalling the incidents of these three months' work, and the system employed to produce the quickest results, it seems that no mistakes were made and that every moment was counted.

To better illustrate the magnitude of the skeleton, I may say that there were girders weighing 40 tons, many columns of 10 and 12 tons each, and cantilevers of 80 tons (in four sections of 20 tons each), the length being 67 feet.

All of these heavy members required special means of transportation ; the heaviest girder had to be rolled from the dock to the building by night, the task requiring three nights. It took just twenty minutes to raise it from the street to its position on the second floor.

On account of the great risks where material must be raised 300 feet in the air, and the haste with which the work must be done, the setters of iron and stonework should be picked men with certain qualities, the most prominent of which must be good judgment and steady nerves. It is rarely that serious accidents and even deaths are not recorded against buildings of even less magnitude than the Manhattan Life Building, but, strange to say, in this case there was no loss of life, and but few accidents worth mentioning. The work was greatly facilitated by the use of a travelling frame, with a derrick at each angle, by which material could be easily disposed of as it was raised from the street and placed in its proper position.

It was considered advisable to begin the brick masonry when four storeys of the steel frame had been set in position. This enabled the frame-setters to keep in advance of the other trades. As far as possible this plan was pursued throughout, but inasmuch as bad weather has no effect on iron and steel, while with masonry the contrary is the case, at times it was necessary to lay off the masons while the others pursued their work. When high winds prevailed all work had to cease. But with good weather, when all could work advantageously, the masons could hardly hold their own.

There seemed to be a friendly rivalry between the two trades as to which should outstrip the other, and the greater the exertion the brighter was the prospect of closing in the building before cold weather set in.

Rough piping both for plumbing and steam began when the masons had reached the fourth storey, and continued without interruption until all the lines, vertical and horizontal, with all their branches, were in position. In the meantime the masons had begun setting the fireproof blocks forming the partitions, and as far as practicable this was carried along with the advancement of the outside walls.

When the partitions of a storey had been set, the electrician ran his wires, enclosed in conduits, to the various fixture outlets. One can hardly realize now that this "roughing," as it is called by the workmen, is concealed from view—that more than five and a half miles of gas, water, waste and vent-pipes, five miles of steam pipes and thirty-five miles of electric wires were required to perfect the respective systems. The facing of the front on Broadway contains about 30,000 cubic feet of stone, which was cut and set in position in eighty days.

It was not at first the idea to undertake to finish more than ten storeys by the first day of May, as the plastering could not