pound hammer. In order to secure a perfect adhesion and union of the different layers of material, especially when fine sand is used, it is generally the custom to cross cut the surface of the last layer deposited, in order that the superincumbent thickness may be thoroughly united to it.

There are two kinds of moulding to which the Coignet béton is applied, the first being used when the material is employed en masse in place, the second when it is moulded in blocks to be subsequently employed. The moulds which are intended to be used in place are composed of close boarding kept in position by means of cross bracing. This mould carries the ornaments which are destined to appear upon the face of the structure after completion. In the second class of work all kinds of ornament can be produced from cornices to statuary.

Of late years the application of the Coignet béton has been equally extensive and varied. In Egypt, where it has been employed in a vast scale, light-houses have been reared out of the almost impalpable sands of the Isthmus of Suez. In Paris, some 40 miles of sewers have been constructed of the same material; and arches of the basement buildings of the Exhibition of 1867, saw mills at Aubervilliers, the numerous cellars of many private houses, entire buildings of five and six storeys in height, the railway bridges at Sainte Colombe, on the Paris, Lyons, and Mediterranean line, a church at Véritet, and above all the large works connected with the new Paris water supply, and some examples of which we illustrate in Plates XXIII. and XXIV.

The exact proportions of materials employed on works of different classes, and with sand and lime produced from different districts, will be interesting. Thus the work about the Exhibition of 1867 was formed of a mixture by bulk of 5 of sand, 1 of lime, and ¾ of cement. The same proportion holds good for the sewers, and the rapidity of setting is so great, that the centering can be struck within ten hours after the béton is got in place, and the sewers can be put into service in four or five days after their completion. Arches, of which the rise is one-twentieth of the span, are generally made with a mixture of 5 measures of sand to 1 of lime, and ⁴ of cement.

The church at Véritet is one of the most interesting of the monolithic structures, and was constructed of sand from pits at Véritet. The mixture was 5 of sand to 1 of lime and ⁴ of cement. In the saw mills of Aubervilliers, where there are arches 27 ft. 10 in. in span and 13½ in. thick at the crown, the proportions are also 5 of sand, 1 of lime, and ⁴ of cement. One of the most generally useful applications of this material is in the construction of the basements of houses. In France, stone piers, supporting rubble masonry arches, are frequently employed, involving numberless joints, and causing an absence of perfect uniformity. From this cause numerous settlements ensue, which are avoided by the use of the homogeneous béton; for the whole substructure can be made in one single block, over which the superincumbent load is equally distributed, and a uniform pressure upon the foundation is obtained. One house, in the Rue de Miromesnil, Paris, is constructed entirely of béton, and it contains two staircases, the one formed in the usual way, with a number of moulded blocks, the other a spiral staircase, from basement to garret—a monolith.

Plates XXIII. and XXIV. show two examples of the monolithic aqueducts constructed in connexion with the works for the supply of Paris with water from the Vanne. The distance of Paris from the source of the Vanne is more than 94 miles, and in its course to the city the line has to traverse a series of valleys and ravines, and to cross rivers, roads, and railways, and the numerous requirements of the works have involved the formation of extensive bridges, aqueducts, syphons, and tunnels, those including an immense reservoir close to the park of Montsouris, and a long aqueduct upon arches adjoining the old Roman aqueduct of Arcueil. But the heaviest works upon the undertaking are those crossing the valley of Fontainebleau for a distance of more than 25 miles between the river Loing and the river Essonnes. This length, almost entirely without building materials, would have involved very costly works if masonry had been employed, and the engineer-in-chief, M. Belgrand, therefore availed himself of the Coignet process, and, utilising the vast masses of sand that lay ready to his hand, has formed the works of béton. Not only have the aqueducts been constructed of this material, but the tunnels also to the extent of several miles, about 6 ft. 6 in. in diameter and 8½ in. thick, and these were all formed with the same success that has attended the application of the system to the sewers of Paris, the centres having been withdrawn almost immediately after the béton had been rammed into place. The aqueducts crossing the valley are supported upon arches, extremely light, and rising to a maximum height of 50 ft. from the ground. The openings are about 42 ft. 6 in., and the thickness at the crown 15½ in. The success which attended the application of this material in the construction of the narrow openings supporting the aqueduct induced the engineer to extend its use to those wider arches spanning rivers, roads, and railways, and a series of experiments having proved highly successful, monolithic structures, of 98 ft. 6 in. and 115 ft. 9 in. openings, and with one-sixth rise, were rapidly formed. Two of the principal of these works we illustrate, one of which represents the aqueduct across the valley of the Loing, the other the aqueduct of the Grand Maitre in the forest of Fontainebleau.