the forms of which belong to architectural art, and the best construction of which can only be determined by practical experience and the knowledge and skill thence required. The radial joints of all arches must be at right angles to the curve of the arch at that point through which the joint passes. The connection of the arch stones or voussoirs depends mainly on their wedge-like shape, which, so long as the central one, or keystone, keeps its place, prevents any one stone from falling out; but if the joints be not truly directed, so as to lie in the line of thrust toward the centre of the curve, an oblique pressure is caused against the edges of the arch stones, which, in the course of time, causes them to split off. Arches of which the curve is struck from several centers, the curves being tangential at their points of meeting, are always liable to this injury, which is only mitigated when the joints are arranged so as to coincide with the lines which pass through the points of contact of the respective arcs which compose the curve of the arch. Elliptical arches are, for a like reason, more liable to fracture at the joints than circular curved arches. The return joints of the arch stone, under the arch, or in the soffit or intrados, as it is termed, are to be worked and fitted with equal care, so that every stone shall abut closely against the adjoining stones throughout the whole of its bearing surfaces. The arch stones must be alternately of large and small depths, so that a bond may be effected in the direction of the axis of the arch. The upper surface of the arch, or extrados, should not, if the thickness of the arch be small, be throughout parallel with the intrados, if other masonry overlies the work, but the arch stones should be allowed, at intervals, to extend upward, and thus connect with the other work. As the theory of the pressure to which arch stones are subject teaches that this increases toward the lower parts, or haunches, an additional strength is often given to these parts by striking the extrados with a larger radius, thus increasing the height of the arch stones gradually toward the springing points. The impost stones from which the arch at each end springs, being liable to severe pressure and receiving the entire weight borne by the several stones of the arch, are frequently made of harder stone than the rest of the work. Thus granite is sometimes introduced for these stones, while the rest of the work is executed in sandstone and limestone. All the delicate and architectural details of buildings, as entablatures, friezes, enriched cornices, also parts of ornamental columns, pillars and pilasters, have the joints rubbed carefully after dressing, so as to render them as far as possible invisable when combined in the general design.

CONCRETE AGGREGATES.

The use of concrete for every kind of construction has become so general, writes Warner H. Jenkins, C.E., in Municipal Engineering, that the quality of the materials of which it is made is a matter of great importance. Specifications prepared for this purpose invariably call for broken stone, to the exclusion of other materials. I find that many persons, who have not given the subject proper consideration, contend that the compound is complete whereby stone, regardless of its quality or texture, enters into the mass. I will here state that as much care should be taken in the selection of the aggregates, stone and sand, as in that of cement. The stone should be perfectly clean and free from flour and dust. The fragments should possess angular faces and be graduated as to size. The theory that limestones contribute to the strength of the mortar with which they are mixed, and ultimately produce stronger concretes, is incorrect. The limestone will invariably produce a concrete that can be termed as tough, but never attains extreme hardness, which is essential in all constructive work. I have also found that concretes prepared from limestone aggregates are much more liable to expansion than other stones. The irregular faces and sharp edges of broken stone are not all the advantages in the composition of concrete. It is essential that the aggregates should vary in size, so as to form a wedge with each other, and thereby permit of being properly compacted by ramming. Care should be taken to exclude long, thin fragments, which invariably crush under pressure, or break in ramming the mass. The best concrete is obtained by using at least two sizes of broken stone, smaller than the largest aggregate. This fact can be readily demonstrated by mixing the stone and placing it in a heap, when the resistance to ramming will be apparent. The use of one size stone is liable to produce arching, even when the presumption is that the concrete has been properly rammed. When preparing concrete I have frequently used screened gravel with equal parts of broken stone. I have found its oval surfaces pack more closely in the interstices of the stone. To sum up the matter, a variety of shapes and sizes in the aggregates are essential for the ultimate strength of concrete.

I would therefore recommend that a percentage of the stone aggregates used in concrete be proportioned into at least two sizes, under the largest aggregate.

Mr. Newton J. Kerr, of the Roadway Department, Toronto, has been appointed assistant engineer to Mr. John Galt, city engineer of Ottawa, Ont., at a salary of $1,200 per year. Mr. Kerr is thirty-five years of age, and has been connected with the Toronto department for about ten years. He is believed to be one of the most experienced young engineers in Canada, with a good knowledge of drainage work. Before leaving Toronto Mr. Kerr was tendered a complimentary banquet by his associates in the Roadway Department and a number of other friends.