The Masonry Arch

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It occupies a distinct place in architecture which leads to the top of the structure and even on to eternity.

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The arch was old in the days of Abraham, Isaac and Jacob.

Abraham's father, Terah, was a master builder in Ur of Chaldea. The arch was well developed in their day, having a Semicircular intrados; intrados being the curved underside.

Ur was a beautiful city all built with brick. The bricks were of good size, being 12 inches square and three inches thick. Later, the craftsmen inscribed them for their kings as they were public works builders. These craftsmen were skilled, for we read that their King, Hammuraki, decreed:

"If a builder erects a house for a man and does not make his construction firm, and the building collapses, the builder shall be put to death."

The art of masonry and the making of brick is one of the oldest professions known to man as it can be traced back 4000 years before Christ. The conception may have come about by some enterprising young man who lived near the Tigris and Euphrates Rivers. He apparently felt it was easier to cut the dried mud into cakes and place them one upon the other, thus creating a house. This method was used instead of searching the plains of Chaldea for sticks and boughs and plastering them one upon the other with mud. Stone was provided by nature, but brickmaking in this manner and placing them one upon the other created a building, using pure ingenuity.

The use of mud bricks led to the early development of the arch. The early arches were corbelled affairs, made by projecting each succeeding layer until the sides were set against the middle. To erect an arch, you must first use a template form or some other type of support. Since few trees grew on the plains of Chaldea and the lack of wood for centrings, the Chaldean's devised a clever way of vault construction, mainly used for burials.

The Chaldean's cut back one end of the two parallel walls as much as 45 degrees; by laying a ring of brick on this support they spanned the opening. Each succeeding ring of brick was laid at a 45-degree incline for the length desired. During the construction, the incline may have become greater than 45 degrees, thus resulting in the invention of the arch.

An arch is made up of wedge-shaped pieces, neither oblong nor square, arranged together to bridge an opening wider than any of its single units. The principle of the arch is its ability to harness the gravity to wedge the voussoirs, (which is a wedged shaped stone), or units together and to transmit downward pressure into thrust of pressure outwards. To keep them stable, suitable abutments had to be used to restrain this thrust.

The knowledge and use of Geometry were an integral part of the temple building by the master builders. While their tools were less sophisticated than modern tools, they were nonetheless effective. A builder, in squaring a building, would square the rods or establish ropes of units of three, four or five lengths. When these rods were placed together end to end, they formed a right-angle triangle which could also be used as a square, level or plumb. The compasses could be a rope of any length. Using simple Geometry, a building would be laid out square, and by bisecting angles any point of the compasses could be aligned.

The Keystone has been traced to nearly 460 years before the building of King Solomon's Temple, or around the year of 1540 BC. It was probably constructed by the Superintendent so his builders could fill the remaining space in the arch. At first it was known as the round comer, the head being understood as the top and the Keystone as the headstone of the comer.

In Psalms 118, Verse 22, is found the passage "the stone which the builders refused, has become the headstone of the corner."

The Ishtar Gates of Babylon formed the main entrance, established by King Nebuchadnezzar; its tower rose to a height of over 40 feet, connected by a vaulted arch. The Captives of Jerusalem entered this gate. After IO weeks of years, King Cyrus captured Babylon and proclaimed the captives free to return to Jerusalem. This proclamation was found inscribed on the brick of an arch surrounding the doorway of a temple in Ur, which Cyrus had rebuilt.

The advent of the Roman Empire saw the extensive use of concrete, skilfully worked by their master builders. Their use of the semicircular arch was so extensive it came to be known as the Roman Arch.

When the Huns eventually felled the Roman Empire, it marked the beginning of the Dark Ages. The only building from the time of Charlemagne was done by the monks of the churches and all building was based on Roman Architecture.

Introduced at this time was rib vaulting which erected piers supporting arches running diagonally across the square. This created a diagonal arch, and being flatter than most arches, created problems both structurally and aesthetically. Gothic Architecture and the pointed arch corrected this.

Near the end of the tenth century knighthood flourished. While there was fighting and much rivalry among the various city kingdoms, the fighting was turned to a chivalric advantage by the church. It did so by enjoining upon the knightly penitents a pilgrimage to the Holy Land. It is possible that the Templars returned with the knowledge of the pointed arch.

The First Proposition of Euclid asserts when the circles of equal diameter are made to intersect each other, the point of intersection with themselves and with the common diameter are joined by straight lines, forming the equilateral triangle. The curved section between these points describe the figure known

as the Gothic or pointed arch, which has a more direct thrust and any width opening can be covered at the same height.

The Gothic System was a method of piers and arches used in a skeleton form of building, allowing doors and windows to be placed at any desirable plane. This created high interior arches so flying buttresses were designed. These are half arches, one end of which rests on massive columns, the other against the main structure. This stabilized and balanced the structure.

Gothic Architecture spread as the beauty and possibilities of the pointed arch became known. This was the cathedral building era with a great religious awakening. One author described the period as a cathedral crusade.

The arch has been found in aqueducts bringing water, the sustenance of life. It has been found carrying the offal of man. Through its portals have passed kings and paupers, free men and slaves. It is used at gateways to cities, palaces, cathedrals and prisons.

The arch then occupies a distinct place in architecture which leads to the top of the structure and even on to eternity.