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## Engineering Problems Since King Tut Was A Kid

BY RUSSELL M. KROB, '23

 THE first feats of engineering of which we have any historical proof are the pyramids, the sphinx, the temples and obelisks of Egypt. Although the Egyptian had a knowledge of astronomy, mathematics and geometry, it is impossible for us today to determine how they constructed these monuments, especially the pyramids. The methods of quarrying, of transportation, of expert stone cutting and of the raising into position of the huge blocks of stone, some of which were twenty feet long, are still unanswered problems. The Egyptians were the first to use the column and the flat-beamed roof. They were very wise in their selection of granite and limestone for building stones, otherwise these excellent examples of the ancient art of building would not be so well preserved after these thousands of years.

But the Assyrians and other inhabitants of the Tigris and Euphrates River valleys did not build so strongly and so well. They discovered the kiln and had kiln-burnt brick, but they used this and stone merely as a facing for a sun-dried brick construction and as a result their buildings are today but mounds of clay. Their structures were almost contemporaneous with those of Egypt.

Several thousand years later in Greece, architecture of the highest degree of refinement was attained. They used marble to a large extent. The Parthenon in Athens is the culmination of architecture both past and present. For instance, it was built on slightly curved lines in order that the lines might look perfectly straight and the columns were all differently spaced so that the spacing would appear to be equal. No other building was ever designed with such a high degree of care. The Greek used the column, the flat-beamed roof and the pitched roof, and there existed an example of a corbelled arch and a vault.

The Romans continued the development of architecture but not with the refinement of the Greek. They used circle arcs instead of free-hand curves and forced ornament and decoration instead of structural necessities, hence their buildings lack the individuality of the Greeks. Concrete faced with stone or marble was the chief method of construction. They also used terra cotta. They may be said to have really discovered the semi-circular arch, vault and dome. The dome of the Pantheon in Rome, which is the largest in the world, is 142 feet 6 inches in diameter. The Romans also engineered the construction of bridges, aqueducts and roads.

In the early Christian and Byzantine periods, churches were the chief buildings constructed. The two great examples of Byzantine attainment are St. Mark in Rome and St. Sophia in Constantinople. Domes were used quite extensively, especially in the Byzantine style.

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Romanesque, the next step in architectural development, is also a period of church building. Brick was used to some extent. This style spread into France and Germany, but nothing new was developed, except in southern Italy, where the pointed arch came into use.

The Gothic in Europe followed as a necessary sequence to this pointed arch Romanesque style. Gothic was a complete change from the horizontal to the vertical in architecture. The lofty stone vaults and towers seemed to be actually striving to attain a great height. Every vertical support depended on being stayed by a buttress which, in its turn, was weighted by a pinnacle. Every arch thrust was counteracted by another. Each country put their own individuality into this style and it is hard to say which produced the best.

With the Renaissance came the reversion to the old Roman art of building. It began in Italy, followed by France, England, Spain and Germany. Probably the greatest building of the Renaissance was St. Peter's in Rome. It has a double shelled dome, the diameter of which is almost as great as that of the Pantheon.

About the time of the decline of the Renaissance, America was settled and we built all types of buildings in a semi-classical or Colonial style.

But, with the advent of steel construction, came a new problem in architectural engineering. All steel and reinforced concrete buildings are now used extensively, especially in large structures, and to dress them up properly is an extremely hard proposition. We in America have built a 55-story skyscraper, which is quite a notable achievement.

During the last century there was a near-reign of terror in architectural design—however, we are finally reverting to the old styles of architecture and are adapting them to our new and varied problems.