

# The Graphic Laboratory of Popular Science

## Arch a Boon to Bridge Builders

● Neolithic man was the original bridge engineer. He discovered the principle of the arch when he leaned two stones together. Ancient man of later periods developed the science of bridge building from this first stone arch. All this was discussed in an article in this department last Sunday.

By JOHN A. MENAUGH

IN THE middle ages bridge makers still had only two basic materials with which to work that were available in quantities sufficient for their purpose. These were stones and timber, although, of course, in some cases bricks could be substituted for stones. Rope for temporary suspension bridges also was readily obtainable in this early day, but permanent structures of this type were a much later development, the first chain suspension bridges appearing in



(© Underwood & Underwood photo.)  
The Rialto bridge over the Grand canal at Venice consists of one great marble arch with an arched structure above.

the world merely a few centuries ago, and the first wire cable structures of this form within comparatively recent times.

By the beginning of medieval times, however, bridge builders were better engineers than were the ancients. They could span wider rivers and deeper ravines through their better understanding of the principle of the arch and the rules of stresses.

Throughout Europe today are standing bridges that were erected in the medieval period, some of them still in a remarkable state of preservation and some of them virtually as steady and strong as they were the day they were completed. In a large number of cases these bridges of the middle ages were constructed upon the principle of the arch, employing either a single arch or a series of arches.

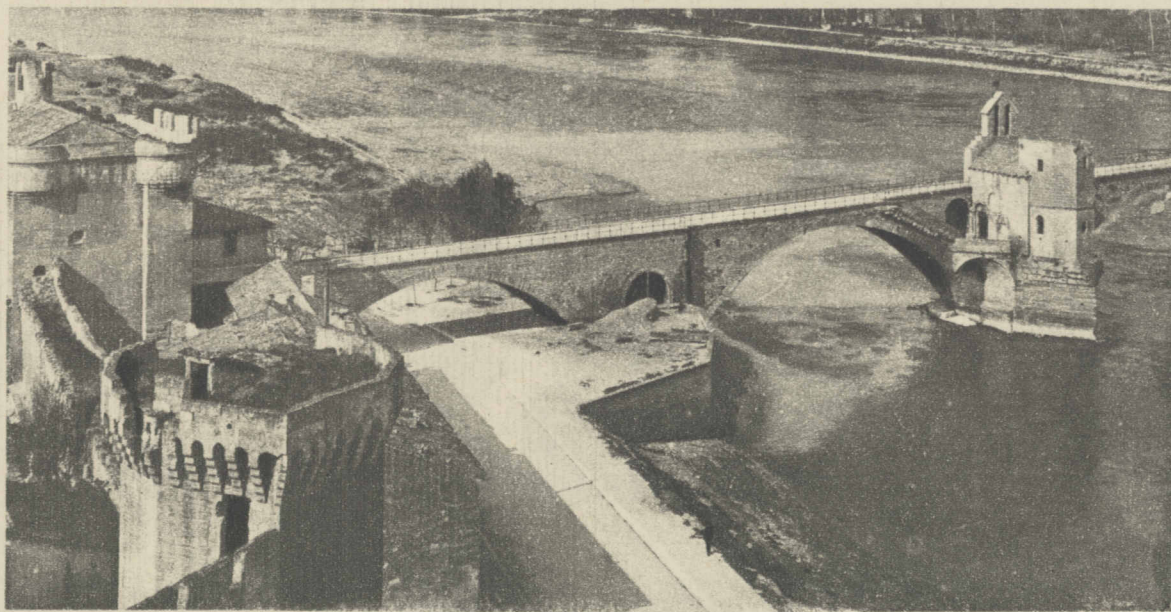
As proof of the fact that men could build marvelous bridges hundreds of years ago is the famous Saint Benezet bridge in the historic city of Avignon, France, which is shown in one of the accompanying pictures. This massive structure was built across the River Rhone in the years between 1177 and 1185, after all previous attempts to span the swiftly flowing stream had failed. Even the Romans, superb bridge builders of their day, had been unable to span the Rhone at this place.

That the builders of this bridge were able successfully to anchor firm foundations for the structure at the bottom of the river is not mystifying today, for it is recorded that these early builders had learned to improve upon the practices of the Romans. In planting a buttress or a pier in a swift river in that time the builders could resort to one or more of the following methods:

Divert the stream and build in the temporarily dry river-bed. Drive piles in the river bed and build on top of them.

Drop rocks into the river to make a solid bed on the river bottom. These rocks could be dropped singly or sunk in barges. Build cofferdams to keep out the water.

In the case of the Rhone it is not likely that the river was



The famous Saint Benezet bridge of Avignon, France. Erected in the twelfth century, it was used for 500 years. Four of its eighteen original arches still are preserved.

diverted. Possibly more than one of the other three methods were employed. Even the Romans had been familiar with cofferdam building, the use of cement, and piling, ancient records have disclosed.

In the original structure of the Saint Benezet bridge were eighteen huge semicircular arches resting upon giant boatlike stone piers. For about 500 years, or until 1680, this bridge was in constant use, except for those times when it was undergoing repairs. Today there are left only three of its massive piers and only four of its great stone arches, but they still are solid and safe after 750 years.

The span of the arches of this old bridge at Avignon was approximately the maximum for its particular type of construction—between 75 and 100 feet. Except in certain rare examples this limit to the length of bridge spans never was greatly increased until relatively modern times, when beams of metal were put to use. Outstanding of the rare examples was the granite arch bridge built over the Adda river at Trezzo, Italy, in 1380. Its arch was 251 feet in length, but it remained intact only thirty years.

Not so old as the Saint Benezet bridge, but built upon similar lines, with massive semicircular arches and heavy buttresses, is the historic Charles bridge (Karlsbrücke) spanning the Vltava river at Prague, Czechoslovakia. Erected in the fourteenth century by Emperor



Prague's celebrated Charles bridge, which was constructed in the fourteenth century and still is in use.

although in their lines themselves they are impressive and pleasing to the eye. They represent the bridge architecture of northern and western Europe in medieval times.

In southern Europe, particularly in Italy, bridge designers in those and in later years placed great emphasis on decorative features. The celebrated Ponte Vecchio that stretches across the River Arno at Florence is typical of the fourteenth-century bridges of Italy. It was erected in 1345, and it is believed that its designer was Taddeo Gaddi. Three low segmental arches resting on stone piers carry the structure across the river between the two famous picture galleries, the Uffizi and the Pitti. Like many of the bridges of its period, the Ponte

fizi palace with the Pitti palace.

In Venice, a city of many and beautiful bridges, are two that are world famous—the Rialto bridge over the Grand canal, and the Bridge of Sighs, which connects the old doge's palace with the Prison of Saint Mark. The last-named bridge perhaps is the most widely known of all.

The single great marble arch of the Rialto bridge rests upon a foundation of 12,000 piles driven to a depth of sixteen feet on the banks of the canal. These piles were sunk by means of a hammer (a heavy weight falling in a groove) that was operated either by man power or horse power, since steam piledrivers were not in existence when the bridge was erected in the years from 1588 to 1592. Designed by Giovanni Contino, the Rialto bridge is of the arcaded type of construction, and in its design



(© Underwood & Underwood photo.)  
Perhaps the best-known of all bridges is the Bridge of Sighs in Venice. It is merely a covered passageway upon an arch that is suspended between two buildings.

Charles, it still is in use today after more than 500 years of service. It was built to replace the stone bridge of Queen Judith, of which the beautiful bridge tower on the left bank of the river has been preserved to this day. A similar tower stands at the other end.

As can be noted from pictures, the Saint Benezet and the Charles bridges were extremely substantial structures, built for service rather than for beauty,

Vecchio is lined with stalls or shops for small tradesmen. The old London bridge, which was torn down centuries ago, likewise was lined with merchants' shops, although it was not of the arch construction type.

A little more than 200 years after the Ponte Vecchio was built, Vasari, the artist, added an upper story to it to provide for a covered corridor more than a third of a mile long connecting Cosimo de' Medici's Uf-

can be seen the Roman, the segmental, the Gothic, and the Moorish arch.

The Bridge of Sighs is a relatively small structure, the springs of its one arch thrusting against the walls of the two buildings which it connects. Erected in 1595, it took its name from the fact that condemned prisoners walked through its covered passage from the hall of judgment in the palace to the place of execution in the prison. The Bridge of Sighs in New York, connecting the Criminal Courts building with the Tombs prison, got its name from the famous bridge in Venice.

Next Sunday—Eighteenth century and modern arch bridges.

## Mostly About Dogs

By BOB BECKER



A champion Cairn terrier and his prize-winning son. Left: Champion Cragwood Gallant Fox, with Cragwood Pixy's Gallant Son. These two dogs are owned by E. L. Walker of San Francisco. (Romaine photo.)

## Cairn Gains in Popular Esteem

THE American Kennel club today recognizes twenty-two terriers. Included in this group are some breeds that are very popular here in America. Terriers have been developed in Ireland, Scotland, England, Wales, and other countries. The ancestry of one of the breeds, the Lhasa, which comes to us from Asia, can be traced for more than 800 years.

Not all terriers are as popular as the Scotty, the fox terrier, schnauzer, Kerry, Irish, and others which have won many friends here in America. And in this group of dogs which aren't so well known we have some which slowly are gaining in popularity. In this list is the Cairn terrier, a short-legged little sporting terrier with an appearance and certain qualities that reflect his usefulness and his sporting instincts.

Terriers are what they are today because of the way they have been used for many years. They have been workers. They come from dogs that were accustomed to go to earth for foxes, otter, and smaller animals. So



(Tribune photo.)  
Two champion Pomeranians, mother and son. Both were imported from England by the Blackacre kennels.

that doesn't mind weather and can handle himself beautifully. He's a rough-and-ready fourteen-pound chunk of dog that can pay his way as a rat killer around the premises. If any dog might be said to have come from a line of working terriers this fourteen-pounder is the one.

The histories of some of our terriers are very interesting to the dog fancier. The way some of these breeds have been developed (sometimes by cross-breeding) and the names given to them years ago form fascinating chapters in the stories of dogs. The Cairn today bears a name that is somewhat misleading. We often have wondered why it isn't called the Skye terrier, because it represents a successful attempt to preserve the old-time working terrier of the Isle of Skye. Harding Cox, an English authority on dogs, sums up the situation in this way:

"I am wondering how it came about that the typical working terrier of the fair island of Skye came to be called the Cairn. I believe that at one time in Skye there was to be found a dog with longer coat and back than are possessed by the right son of the soil—the Cairn. So I suppose that ingenious eugenisists saw in this animal the basis of the picturesque fancy breed which might win the hearts of dog lovers."

But, irrespective of the differences of opinion on the question of the appropriateness of the name Cairn, the breed continues to win new friends. The number being registered is some-

thing of a surprise. During one recent month 41 Cairns were registered with the A. K. C. In that same month 44 bull terriers, 38 Kerry blues, 23 Norwiches, 44 Sealyhams, and 31 Welsh terriers were put on the books, which gives the dog fanciers some idea of the standing of the little Cairn among certain terrier breeds that so far are not challenging the big registration figures of the Scotty and the wire-haired fox terrier.

The registration figures on the Scotty and the wire-haired terrier give one a pretty good idea of their national popularity among breeders, at shows, and in homes. During one month of this year 765 Scottish terriers were registered with the American Kennel club. That same month put 539 wire-haired terriers on the books. These two breeds, commonly hitting the 400 or 500 mark each month, naturally take the race from other terrier breeds in this country.

## DOG NOTES

A dog that is ten years old has reached an age comparable to 70 years in a human, since one year of a dog's life is equal to about seven of a human's.

The Boston terrier as a breed is about 70 years old.

The popular cocker spaniel recently scored with 1,471 individual dogs registered with the American Kennel club in one month.



(Tribune photo.)  
Champion Brock von Lubich, a black standard schnauzer, is a representative of this German terrier breed which has been in existence since the fifteenth century.

they naturally are very active, full of courage, and extremely alert. In other words, all terrier. This description fits the Cairn terrier very well.

A Cairn male should weigh around fourteen pounds. A female tips the scales at thirteen pounds. The coat is hard and weather-resisting. Actually the Cairn has a double coat. The outer one is profuse and harsh. Beneath is a soft, furry one.

The Cairn is fortunate in being of a size suited to the requirements of city life. In its native land (the island of Skye) the Cairn lived an outdoor life under anything but year around favorable conditions. Centuries of such a life naturally have developed an active, rugged little dog



● For attractive offers of dogs, turn to the Dogs, Cats, Birds, and Pets columns in the want ad section of today's Tribune.