

The Graphic Laboratory of Popular Science

Arch Bridges in Modern Times

● The history of bridge building has been divided by authorities on the subject into six distinct periods.

● The first period begins with the prehistoric and has to do with the most ancient forms of structures. The second or Roman period extends from about 300 B. C. to A. D. 300. The third covers the middle ages in Europe. The fourth is that of the Renaissance, the sixteenth and seventeenth centuries. The fifth includes the eighteenth century and the first quarter of the nineteenth. The sixth or modern period begins about 1830 and extends to the present day.

● The four first-named periods, so far as they concern the arch bridge, have been discussed in two previous articles in this department, which brings us to the arch bridges of the eighteenth century and later.

By JOHN A. MENAUGH

MOST NOTABLE, perhaps, of all bridge designers of the eighteenth century was the Frenchman Perronet, who is recognized as actually the first professional bridge engineer. It was he who designed and built in 1768 the famous bridge over the Seine at Neuilly, a suburb of Paris—a structure of five stone arches, each with a span of 120 feet. The Pont de la Concorde, built by Perronet in 1788, was the first bridge in Paris to be constructed with segmental arches, its four spans being only about one-eighth as high as their lengths.

Perronet, like bridge builders who preceded him and also like those that have followed him, restricted his designs in the main to structures employing simple or basic arches. It was only when builders wished to ornament their bridges that they incorporated into their plan arches of more advanced or decorative types.

It might rightly be said that the full development of the arch came only with its use in the construction of buildings, although the earliest use, perhaps, was in the erection of bridges.

Accompanying the first article of this series were drawings of twelve of the simpler types of



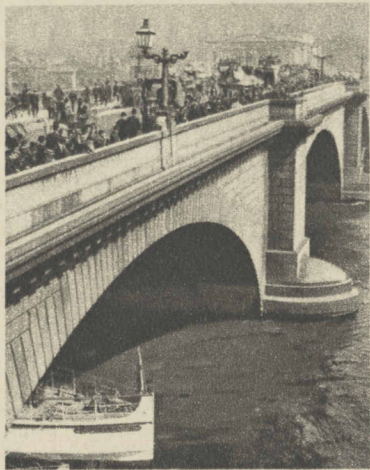
(Ewing Galloway photo.)

Sydney harbor bridge, a typical example of modern steel arch bridges. Its single span is 1,650 feet long.

arches. With this article are shown drawings of additional arches, some of the early or basic types and others of the later developments, such as the Moorish, the Gothic, the Tudor, and the modern arch.

The Moorish arch reached its finest form from the seventh to the tenth century, when the Mohammedan conquerors of Spain were erecting magnificent structures in Cordoba. The Moorish arch is fundamentally a decorative arch. The Gothic arch, of which there is a variety of forms, depending on racial influences, was a development of the Romanesque and came into being as a beautiful type in the thirteenth and fourteenth centuries. Its application in early days is seen in large ecclesiastical structures such as the famous old cathedrals of Europe. In bridge construction its use has been restricted. The Tudor arch, as the name implies, came into use during the reigns of the English royal family of which Henry VIII. and Elizabeth were members. It also was almost purely a decorative arch and is not used to a great extent in bridge building. Modern arches, of which an example of the American type is shown in the accompanying drawings, is applicable to both building and bridge structures.

The first departure in arch bridge construction from the type employing original materials, such as stones, brick, and timber, was in 1776, when a



(Underwood & Underwood photo.)

The new London bridge, which was designed by John Rennie and completed in 1831. Of stone arch construction, it crosses the Thames at the same place as did the famous old London bridges.

not see the completion by his sons of the new London bridge.

Although now more than 100 years old, this bridge still is called the new bridge to distinguish it from the bridges which previously stood in the same place, the first of which was a wooden structure built in the time of the Romans and the Saxons. The story of London bridge is said to be the history of England. The present bridge, which spans the Thames river in a total length of 926 feet, comprises five masonry arches of elliptical form. Its roadway originally was 35 feet wide, but in 1905 it was extended to 65 feet, and twenty-three years ago,



(E. Meerkemper photo.)

Landwasser viaduct, a celebrated arch masonry bridge of the Swiss Alps.

cast iron arch bridge was built over the Severn river at Coalbrookdale, England. The bridge, which is in use today, has a central span of 100 feet, employing semicircular ribs of the aforementioned metal instead of arches of stone. Since cast iron proved to be very brittle, it was found to be unsatisfactory, despite this notable success.

Most famous of the bridge engineers of the early years of the nineteenth century was John Rennie, who designed three famous London bridges and numerous other structures. Of the three London bridges, the Waterloo bridge was erected in 1817, the old Southwark bridge, a cast iron structure, in 1817, and the new London bridge, which is shown in one of the accompanying pictures, in 1831. Rennie died in 1821 and thus did

by insertion of massive stone corbels (projections), it was increased to 76 feet. The piers of the bridge have circular cutwaters that are slightly pointed.

Resting on timber platforms supported by pilings driven into the bed of the river, the new London bridge, like the Waterloo bridge, has borne extremely heavy traffic for more than a century. It has been only with recent years that it showed any signs of deterioration.

At the time of the completion of Rennie's bridge masterpiece in 1831 stone still was the principal building material utilized in such work, although, as has been pointed out, cast iron was employed back in the eighteenth century. Wrought iron bridges after a number of years followed

cast iron bridges. The Bessemer process for the manufacture of steel was invented in 1855 and the open-harth process soon afterward. Even with steel available, engineers continued for some time to adhere to the masonry principle.

A striking example of a stone arch bridge that was built since metal came into wide use for the purpose is the famous Landwasser viaduct, which carries an electric railway 213 feet above a wild 426-foot-wide chasm in the Swiss Alps. This bridge, as an accompanying picture discloses, comprises six massive arches, each 66 feet wide, built upon tall piers of the same material.

No small number of modern-day steel bridges are built upon the principle of the arch. Among these are the famous Hell Gate bridge at New York, the Eads bridge over the Mississippi at St. Louis, the new Southwark bridge in London, the Victoria Falls bridge in South Africa, the Düsseldorf bridge in Germany, the Kill van Kull bridge linking New Jersey with Staten Island, and the majestic Sydney harbor bridge in Australia.

These modern arch bridges employ the principle of the arch in exactly the same manner as did the stone bridges of the ancients. The bridge is supported entirely by the arch, whether the roadway passes over the top of the arch or arches or whether it is suspended from the arch, as it is partly in the case of the Sydney bridge. In a steel arch bridge, naturally, there is no keystone. The entire arch is of steel, riveted or welded into continuous pieces. The weight of the structure is borne on the springs (base of the springers) and the thrust of the bridge is met by massive masonry pillars.

As modern as steel bridges are reinforced concrete bridges. The famous concrete arch bridge over the Seine at St. Pierre du Vauvray consists of a single arch about 425 feet long and 110 feet high. The roadway is suspended from the giant arch by means of heavy metal rods. This method of suspension, however, does not make the bridge a suspension bridge. True suspension bridges will be discussed in a subsequent article in this department.

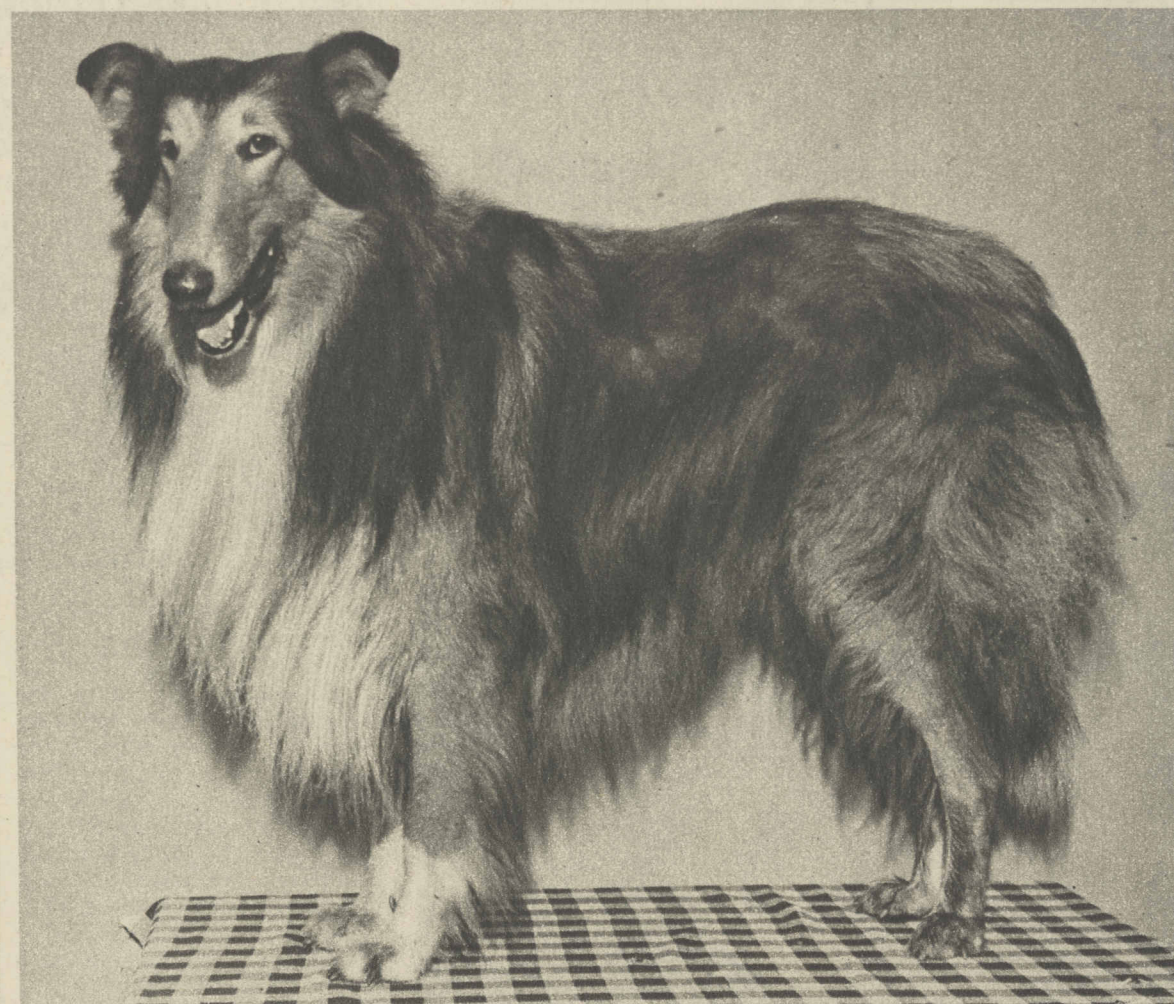
Next Sunday—Independent span and continuous span bridges.

CORRECTION

● In this department of last Sunday's Graphic Section were reproduced photographs of the Rialto bridge and the Bridge of Sighs, both in Venice. By mistake the legends under these photographs were transposed. The Bridge of Sighs was the one shown in the first column; the Rialto bridge was pictured in the bottom illustration on the page.

Mostly About Dogs

By BOB BECKER



Oakland Lukeson, a sable-and-white collie that has won the title of companion dog in obedience tests. This collie was the first of the breed to win the C. D. title in the middle west. (Kolin photo.)

Show Dogs Like Their Careers

WHEN dog show visitors see dogs of various breeds being taken into a ring, walked around before the judges, and then posed expertly they are quite apt to think that these pure-bred specimens are nothing more than living puppets. Although it is true that some breeders do not get much companionship out of their show dogs, most of the show dogs thoroughly enjoy the excitement of being with and around people.

On the other hand, some dogs temperamentally are not fitted for competition in a ring. They won't eat when on a show circuit. Nor will they conduct themselves in a ring in a way to catch the judge's eye. As a show dog breeder or handler would say of such an animal: "He won't show." Such dogs are usually withdrawn from competition.

The American Kennel club points out that most show dogs welcome a chance to go to a



(Tribune photo.)

A Sealyham puppy that has just been trimmed with stripping knife and scissors and then chalked to make it look white and clean.

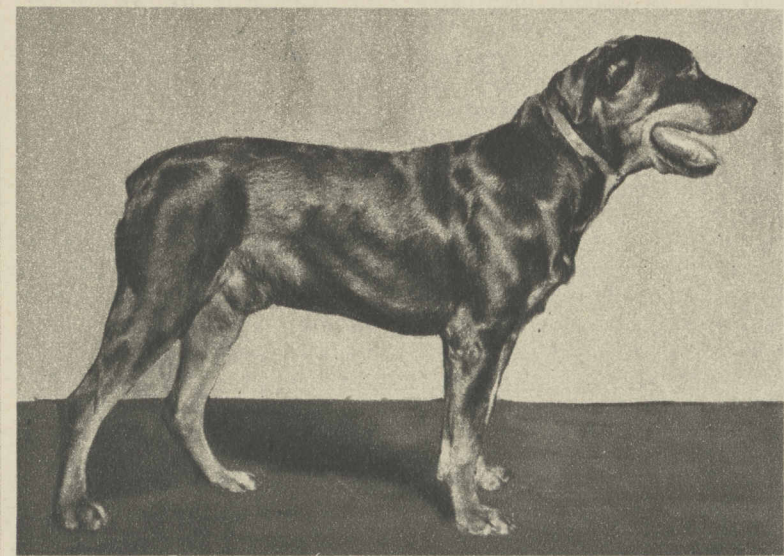
citement, has an exhibition complex, is fond of his handler, and is treated well we can see why such an animal would enjoy a show and the strutting around in a ring. We recall an eastern poodle who won many honors in the Westminster Kennel club show early in the year. When the judges presented a ribbon to the handler and the dog the latter looked up waiting for the signal which would mean that it was no longer necessary to pose and stand still. When the signal was given the poodle would dance and jump around

of the noise. Then he'll sit up, hoping that some one passing by the bench will speak to him or even pet him.

Dog owners often wonder why show dogs have such long and unusual names. For example, names like Madcap of Herds, Pillcock Rumpelstiltskin, Dalshangan Pomme de Terre, Nonquitt Notable, and others may be necessary because it is not easy to give dogs names that never have been used before. It takes considerable ingenuity by breeders to think up name combinations that have not been preempted by other dog owners and will be accepted by the American Kennel club. And it is almost as difficult to originate a kennel name that will be approved by the Kennel club. Keeping records on all pure-bred dogs, including those competing in shows, is the big job of the American Kennel club. Today the American Kennel club office has the names, pedigrees, and descriptions of nearly 1,300,000 pure-bred specimens of 109 breeds. The records are so complete, definite, and orderly that it would take only a matter of hours to give a thirty-generation pedigree on any registered dog. While it might be difficult to trace individual dogs, many of the breeds can be carried back several thousand years. Pedigrees for certain periods have been discovered, but complete records between the years 6500 B. C. and A. D. 1938 are hardly to be expected.

DOG NOTE

A second Hawaiian kennel club has been admitted to membership in the American Kennel club. It is the Maui Kennel club, and it follows the Hawaiian Kennel club, which was admitted in 1937.



(Tribune photo.)

Gero vom Rabenhorst, a Rottweiler. This large, strong working breed comes from Europe and is not often seen in American dog shows.

show, for it means a release from their kennels, which they do not particularly like. There are plenty of dogs at an average kennel, but dogs prefer human society. So when a dog is taken on an extended show campaign he is in seventh heaven. One particular dog that is doing a lot of winning throughout the country is with his handler so constantly that when the man goes to a barber shop for a shave or haircut the dog is not satisfied unless he can sit in the shop and watch the proceedings!

Another dog, retired with all manner of laurels, was taken to shows for nearly a year—merely as a spectator.

Whether a show dog enjoys himself and gets along well on a show circuit depends to a great extent on the care given by the handlers. If the dog likes ex-

as if it were getting the thrill of its life out of the show just won. Here was a show dog that obviously was enjoying its ring experiences and also was very fond of its handler. The combination meant fun for both of them.

Our Clumber spaniel, which has been in several shows, is the type of dog which always will enjoy a show, because he likes people. When he is on the bench he will sleep a while, unmindful



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

Yes, sir!
I'M A FIRM BELIEVER IN ORAL HYGIENE!

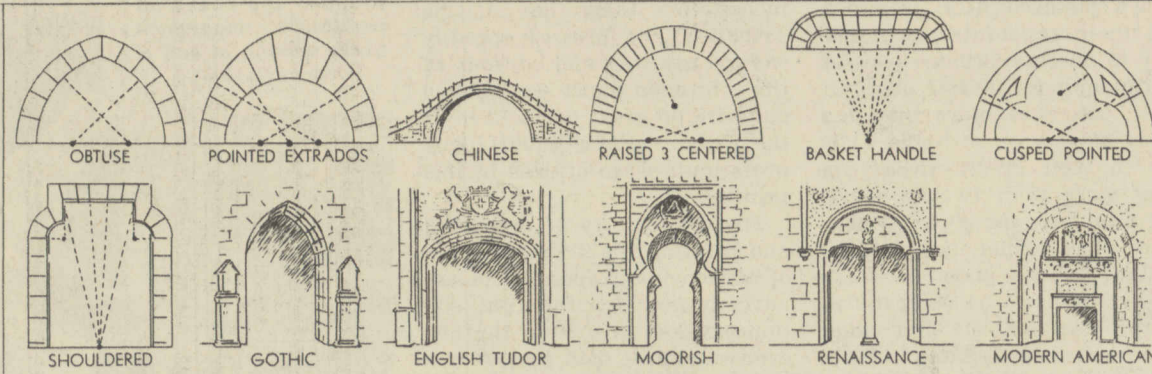


Tip to Dogs . . . Eat Red Heart Biscuits Daily and Avoid Tooth Trouble!

Get in there and chew, fella! If you want to dodge tooth trouble, you need that exercise.

You'll like all three flavors (beef . . . fish . . . cheese) of these famous biscuits. And they are tops in nourishment, too. Contain 24 wholesome ingredients. Good and rich in that important vitamin known as "D" or "Sunshine."

Red Heart Biscuits are economical, too. Your master will like that angle. Heart-shaped biscuits or kibbled, 11-oz. boxes or 28-oz. cellophane bags at grocer's or pet shops. John Morrell & Co., General Offices, Ottumwa, Iowa.



Drawings of various arch forms, some of which are discussed in this article.