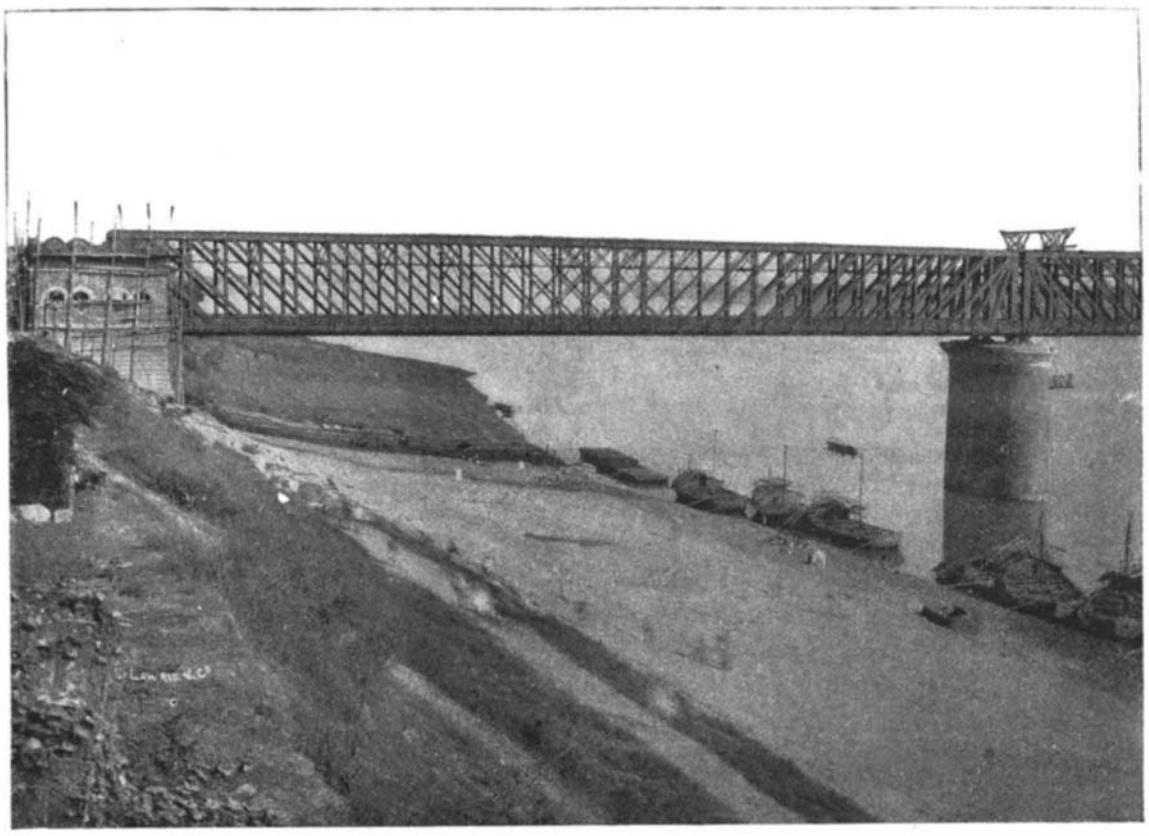
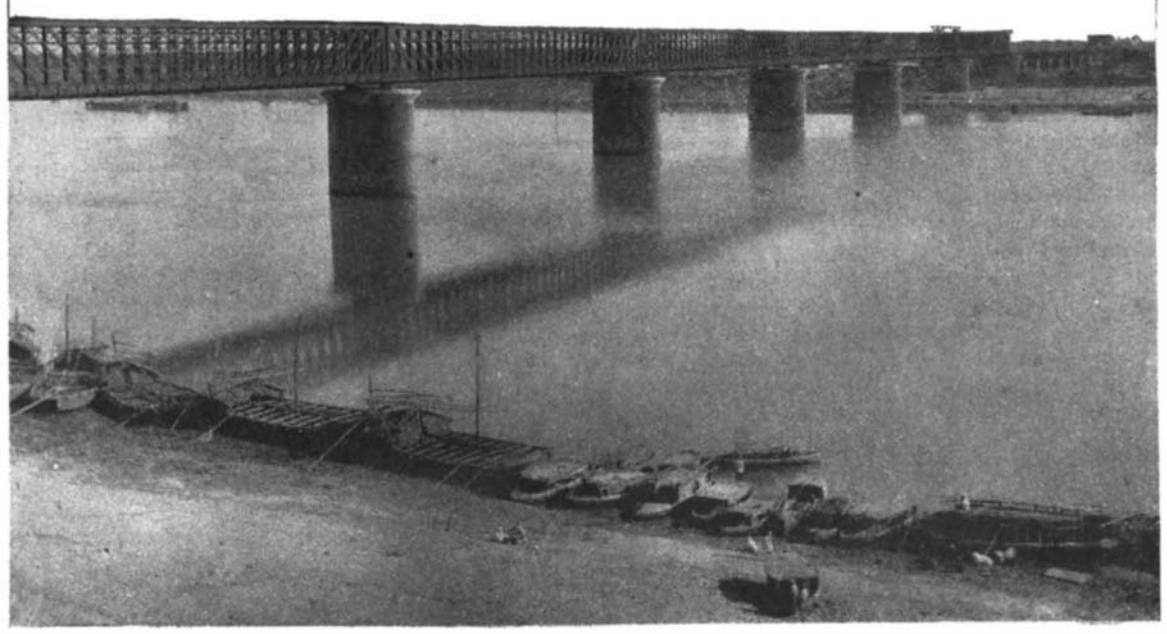
RAILWAY BRIDGE OVER THE GANGES, INDIA.

The accompanying illustrations show the Oude and Rohilkund Railway Company's bridge over the Ganges, at Benares, India. The line crosses the Ganges by three other bridges, one between Chaudausi and Aligarh, another at Cawnpore, and a third at Balawali, the bridge shown being the largest and finest of them all. It was opened to traffic in October, 1887, having been five years and eight months in process of construction. The work was done wholly under the direction of Mr. H. B. Hederstedt, chief engineer of the railway, and the work at Benares was in charge of Mr. F. T. G. Walton, as resident engineer. The details of the steel and iron work of the bridge proper were worked out in England, and the material sent out. The bridge is 3,568 ft. long, the rails 78 ft. and the top of the girders 110 ft. above low water. The greatest depth of the foundations, at pier 4, is 141 ft. below low water. It has seven large girders, 355½ ft. long each, and nine small ones, 113 ft. 8 in. each. The piers carrying the large girders are elliptical, 65 ft. long and 28 ft. broad at the base or foundation block, which was formed with three chambers for excavation in sinking them, making a group of three wells connected in one. Each foundation block was commenced in an iron caisson, varying in height for the different piers, that for pier 3 being 50 ft. high and passing through 30 ft. of water before its sinking was commenced. The wells were all built upon wrought iron kebs made in the locomotive workshops in Lucknow.

The Ganges River at this point is 3,000 ft. wide, with a bed of pure sand, the depth of water in cold weather months being about 37 ft., and rising during the floods to 92 ft., with a velocity of about 20 ft. per second. The bridge is adapted for both rail and cart traffic, the girders being sufficiently strong to support pathways 5 ft. wide on cantilevers, and the space between the girders being laid with ballast, providing a roadway 20 ft. wide at rail level, to be used as a common cartway.

For the photographs from which our views are made we are indebted to Mr. R. Mac Cred, chief clerk in the engineer's office during the construction of the bridge.





THE NEW RAILWAY BRIDGE OVER THE RIVER GANGES, INDIA.

Protecting Iron.

In France it is stated that M. H. Bertrand has devised a modification of the Bower-Barff process, by which magnetic oxide is formed on iron to protect it. The process consists in depositing, by one or other of the galvanoplastic methods, a metal susceptible of volatilization at about 1,000 deg. C. After being coated with this metal the articles are placed in a furnace and heated to 1,000 deg. C. Notwithstanding the envelope, the iron articles become oxidized, but without permitting th oxygen to accumulate in sufficient quantity to form sesquioxide of iron. At the same time the oxygen is enabled to penetrate in such quantity as to form magnetic oxide. and in four or five minutes the process is complete.

Electric Lights for Horses.

Mr. F. B. Stewart, manager of Messrs. Thomson & Taylor, Bombay, has just completed a most ingeniously arranged electrical installation for H. H. the Gaekwar of Baroda. It consists of two incandescent lamps, which are to be worn in the head gear of H. H.'s carriage horses. The light in each of the little glass globes is equal to ten candle power, and the electric current which supplies it is conveyed by two wires, which are connected with six dry accumulators concealed beneath the coachman's seat and pass along the traces, thence up the bridle to the globes, the wires being so strongly yet neatly covered as to be in no way a source of danger to the animals carrying the lamps. —*Indian Engineer.*

Proceedings Engineers' Club of Philadelphia, October, 1891.

This number is devoted jointly to the discussion of the railroad problems of rapid transit and of rail joints. Of the latter, four new forms are submitted.

Mr. Carl Hering submits an illustrated description of a portable photometer, designed and used by him for measuring street lights and illumination in general. The instrument consists of a light wooden tube 4 inches square, about 3 feet long, and open at both ends, containing the usual screen with grease spot and mirrors, and a small electric lamp fixed to a sliding rod, and adjustable at any desired distance from the screen.

The lamp was a small 4 volt incandescent lamp of about one candle power, requiring a current slightly less than an ampere. The accumulators consisted of two cells placed in a wooden box provided with a shoulder strap, which enabled the operator to carry it at his side. The weight of the box with accumulators was about 20 pounds.

Other papers presented are "Notes on Mississippi River Discharge Observations," by Mr. John J. Hoopes, an "Iron Sewer Templet," by Mr. H. B. Hirshm, "An Account of a Photographic Survey," by Mr. Charles H. Haupt, and "Roads," by M. Thomas G. Janvier.

Roman Hydraulic Works in Africa.

At the last meeting of the Academie des Inscriptions et Belles-Lettres, a paper was read by M. Rene de la Blanchere upon the means adopted by the Romans to cultivate their African colonies, which were more densely peopled and more fertile than the same parts of Africa are at the present time. M. De la Blanchere asserts that the absence of water was not the chief obstacle, as a great part of the colony had a plentiful supply, but that the difficulty was to regulate the supply, owing to nearly all the rain falling in a period of a few weeks. In order to obviate this the Romans covered their African province with a network of hydraulic works, which M. De la Blanchere has been studying for the last ten years. The main principle which was observed in the creation and adaptation of these works was that no portion of the water was left to itself, all that fell, from the summit of the mountains to the level of the sea, being, so to speak, captured and distributed methodically. In the smallest ravines there were dams of stones constructed to keep back the water, and at the entrance to each of the large valleys there was a system of works which insured not only regularity of irrigation, but the slow and gradual passage of the water. M. De la Blanchere adduced as a type of this distribution the Enfida, a country on the borders of the Zengitana and Bizacium, describing it in detail, and demonstrating that the same system prevailed not only in Mauritania, but in the whole of Roman Africa, where vestiges of it are to be found in all directions. The Romans were several centuries in arriving at a complete result, the most flourishing period being the third century of the Christian era. After that, civil wars—and, above all, the wars of religion—led to the decadence and destruction of these works, the destruction being completed by the Arab invasion and the disafforesting of the mountains.

Economy of Gas Engines.

Some extension in the use of Dowson's gas for use in gas engines has been made, and Messrs. Crossley & Co. have now a large number of engines using this gas; in one mill alone 200 horse power in gas engines is worked by means of Dowson's gas. When it is remembered that this mode of obtaining motive power is much less costly than the same power from steam engines, it is very remarkable that its use is not extended even more rapidly. We recently made a trial run with a Cycle gas engine worked with this gas, at the Uxbridge water works, and found that the consumption of coke and anthracite coal was only 1·67 lb. per horse power in water lifted, and only a little over 1 lb. per indicated horse power.

Bee Poison for Rheumatism.

Experiments on bee stings as an antidote for rheumatism have already been noted in our columns. (See SCIENTIFIC AMERICAN, vol. 63, No. 11.) One of our old subscribers, Mr. Aaron Miller, has written us to the effect that he has virtually found the sting of bees an antidote to very severe rheumatic pains to which he was subject. Although seventy-four years of age, he voluntarily submitted to stinging, and found it quite efficacious. In one case two days passed after the stinging before the cure seemed to be effected, but the rheumatism almost disappeared for several months after the infliction of a stinging on the eyebrows and left hand.