Canal had 564 miles of main line and 2,050 miles of minor distributaries, and irrigated 519,022 acres of crops. From this it will be seen how important a line of irrigation this canal constitutes, and how urgent the reconstruction of the aqueduct was. The new aqueduct replaces one of much smaller size, viz., five spans of 35 ft., which was damaged by a high flood in October, 1884, and completely destroyed by another high flood in July, 1885.

The Kali Naddi, for the greater part of the year, is a very insignificant stream some 50 ft. in width only, but on the date mentioned it was swollen into a river a mile wide and in places 25 ft. deep.

In addition to the construction of the Nadrai Aqueduct, all the railway and road bridges below it were also destroyed, and many villages swept away.

The proportion of the foundation to the superstructure of the new Nadrai Aqueduct can be gathered from the fact that three-fourths of the expenditure of money and time were consumed by what is now hidden below the ground.

The foundations consist of 268 circular brick cylinders or wells, as they are always called in India, all sunk 55 ft. below the river bed. There are fifteen bays of 60 ft. divided into three groups of five each by abutment piers. The abutment piers consist of a double row of 12 ft. wells spaced 2 ft. apart and the ordinary piers of a single row of 20 ft. wells similarly spaced.

The wells are all sunk through a stratum of stiff yellow clay, averaging 15 ft. thick, into a substratum of pure sand. The wells are all hearted with hydraulic lime concrete filled in by skips, and in each pier the wells, by corbeling out the brickwork, are joined together for the superstructure of the pier.

The total quantity of well sinking was 15,019 lineal feet, or nearly three miles, and was executed by hand and steam dredging. It was commenced in May, 1886, and completed in May, 1888. The arching was commenced in November, 1888, and finished in April, 1889.

The well sinking and arching went on night and day, the work being lighted by ten arc lights of 2,500 candle power each. Now that the aqueduct is completed it forms a most striking object in the vicinity, and will, we hope, stand to bear witness in far distant ages to the beneficence of British rule in India and to the skill of our English engineers.

The solidity of the great arches and piers and the fine sweep of the bastion-like wings all unite to give an idea of vast strength and stability, while the monotony of such a large surface of facade is relieved by the effect of light and shade obtained by the bold corbeling out over the spandrels to form a support for a roadway on either side of the canal, and the long horizontal lines of the cornice and railings are broken up by a tower at each end and one at each of the abutment piers.

The wells were built up on wooden well kerbs laid *in situ*, at first in short lengths of 7 feet, and sunk by Bell's 2½ cubic feet sand dredger worked by hand through a nearly pure stratum of sand until the kerb rested on the clay, about 30 feet below river bed level; the remaining length of brickwork of 25 feet, with 8 feet of false work, was then added, and in the case of the 20 feet wells an additional load of 150–200 tons of scrap rails was imposed to force the kerb through the stiff clay stratum into the sand below. The dredging in and below the clay was performed by Bell's 40 cubic feet dredger worked by steam hoists.

The double row of 12 feet wells in the abutments and abutment piers were similarly sunk, and Bell's 10 cubic feet dredgers worked by steam hoists were employed to take them through the clay, but as there was no room for rails, additional weight was given by an extra length of 10 feet of false brickwork.

These double rows of wells, only 2 ft. apart, gave much trouble in sinking, owing to the tendency of the wells to draw together. The width of 149 ft. between the faces of the arches necessitated three shifts of the centring in each span; this was performed after a length of archwork had been completed by lowering the centering by sand boxes on to trolleys running on three parallel lines of railway, and the whole centering was then dragged forward or shifted to another bay *en bloc* by a steam hoist. Mr. W. Good was the engineer of the work.

Thirty-six Tons of Pennies.

There are 72,800 pounds of pennies encumbering the vaults of the Sub-Treasury. This is more than thirty-six tons, and the coins are still accumulating. There are 10,400 bags, weighing seven pounds each. The accumulation is partly the result of the general establishment of the penny in the slot machines. The headquarters of the companies owning these machines is in this city, and all the pennies are therefore sent here when the agents make their returns. The companies thereupon unload them upon the Sub-Treasury. The Treasury Department will send these pennies to be distributed among the country banks.

THE frying sound in the telephone is caused by induction from other lines, earth currents, and static discharges.

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SCIENTIFIC AMERICAN SUPPLEMENT

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THE UNITED STATES LEADS THE WORLD IN IRON.

The United States now takes the lead in the production of pig iron. The schedule for 1890 stands as follows, allowing for Great Britain and the United States 2,240 pounds to the gross ton; Germany, France, and other states, 2,204 pounds to the metric ton:

United States,	1890	9,202,703	tons.
Great Britain,	"	7,904,214	"
Germany,	"	4,563,025	"
France,	"	1,970,160	"
Sweden,	"	781,958	"
Austria-Hungary,	1889	816,156	"
Belgium,	"	832,226	"
Russia,	1888	612,000	"

It will be seen from the above that the American production for 1890 was more than sixteen per cent greater than that of Great Britain.

The recent report of the Commissioner of Labor says: Only twenty-five years ago Great Britain was so far ahead of all other countries in the manufacture of these products that her manufacturers and statesmen did not dream that she would ever have serious competitors in the world's markets. The iron and steel consuming countries of the world were supposed to be dependent upon her for Welsh rails for their railroads, the finer qualities of Scotch pig iron for foundry purposes, Low Moor and other favorite brands of plate iron for boilers, Crown and other choice brands of bar iron from Staffordshire, English-drawn wire, English hoops and cotton ties, Sheffield cutlery and edge tools, and all kinds of iron and steel machinery, in the manufacture of which great skill is required. At that time the Bessemer steel industry had not been established in the United States, and its possibilities were not understood even in England, where it originated, and we had but just commenced to develop our rich stores of Lake Superior iron ores and to apply our excellent Connellsville coke to their reduction. Germany lagged far behind as a producer of pig iron and steel and all their products.

The basic process of manufacturing steel from highly phosphoriferous ores, with which Germany is abundantly supplied, had not then been invented. But Great Britain was busy making steel by various new and old processes; she had an abundant supply of cheap coal; she had long known the virtues of Durham and other coke; and she had a variety of iron ores in abundance everywhere.

Since those days the United States and Germany have rapidly and even phenomenally increased their production of pig iron and steel, and of all articles made from them. The whole world, indeed, has greatly increased its production of iron and steel in the last twenty-five years, a result which is largely due to the extraordinary development in that period of railroad enterprises in all civilized countries, and to the invention of the Bessemer process, which has made cheap steel rails and cheap transportation possible; but the United States and Germany have made more progress than any other countries, and very much more relatively than Great Britain.

AUTOMATIC CAR COUPLERS.

Although the vertical spring hook style of couplers has been extensively adopted and its universal employment urged by car builders, the automatic couplers of the link and pin style seem to find most favor with brakemen and switchmen. They are the men who are obliged to work and deal with the couplers, and know what they are talking about. At the recent meeting in this city of the National Committee on Safety Appliances, Mr. D. B. Sweeney, of the Trainmen's Aid Association, favored the link and pin type. The vertical hook was too dangerous. They had to go between the cars to open the knuckle. The uncoupling apparatus was always broken. With the link and pin they knew when a car was cut, but when they threw up a lever they could never tell whether it would open or not. There was nothing better than a link and pin.

Mr. John A. Paul, editor of the *Switchmen's Journal*, described vividly the duties of the yard and switchmen, and the difficulties they labored under. Something should be done for them. The railroads were, he thought, doing all they could for them. He had many years' experience in yard work, and preferred the link and pin. The conditions under which these men worked were getting worse, and legislation was necessary unless the railroads accomplished more. A greater number of men were hurt every year. If nothing but vertical planes were used, they would still have to go between the cars—they were out of order so much. He believed the link and pin could be as automatic as the vertical plane. Yet, if all cars had vertical plane couplers, the conditions would be a thousand times better than they were to-day. The switchmen favored uniformity.

Mr. Heberling, of the Switchmen's Aid Association, said that they favored a uniform link and pin type or a uniform drawbar, anyway. If two cars of the M. C. B. type were set together without opening the knuckles, they were sure to break. Give them a uni-