spiral passage, the diameter of which is constantly diminishing. The effect of this operation is to squeeze all the slag and cinder out of the ball, and force the iron to assume the shape of a short thick cylinder called “a bloom.” This process was formerly performed by striking the ball of iron repeatedly with a tilt-hammer.

The bloom is now re-heated and subjected to the process of rolling. “The rolls” are heavy cylinders of cast-iron placed almost in contact, and revolving rapidly by steam-power. The bloom is caught between these rollers, and passed backward and forward until it is pressed into a flat bar, averaging from four to six inches in width, and about an inch and a half thick. These bars are then cut into short lengths, piled, heated again in a furnace, and re-rolled. After going through this process they form the bar iron of commerce. From the iron reduced into this form the various parts used in the construction of iron bridges are made by being rolled into shape, the rolls through which the various parts pass having grooves of the form it is desired to give to the pieces. These rolls, when driven by steam, obtain this generally from a boiler placed over the heating- or puddling-furnace, and heated by the waste gases from the furnace. This arrangement was first made by John Griffie, the superintendent of the Phoenix Iron-Works, under whose direction the first rolled iron beams over nine inches deep that were ever made were produced at these works. The process of rolling toughens the iron, seeming to draw out its fibres; and iron that has been twice rolled is considered fit for ordinary uses. For the various parts of a bridge, however, where great toughness and tensile strength are necessary, as well as uniformity of texture, the iron is rolled a third time. The bars are therefore cut again into pieces, piled, reheated, and rolled again. A bar of iron which has been rolled twice is formed from a pile of fourteen separate pieces of iron that have been rolled only once, or “muck bar,” as it is called; while the thrice-rolled bar is made from a pile of eight separate pieces of double-rolled iron. If, therefore, one of the original pieces of iron has any flaw or defect, it will form only a hundred and twelfth part of the thrice-rolled bar. The uniformity of texture and the toughness of the bars which have been thrice rolled are so great that they may be twisted, cold, into a knot without showing any signs of fracture. The bars of iron, whether hot or cold, are sawn to the various required lengths by the hot or cold saws shown in the illustrations, which revolve with great rapidity.

For the columns intended to sustain the compressive thrust of heavy weights a form is used in this establishment of their own design, and to which the name of