with stone, and founded on concrete. On account of the flatness of the bed of the river, they are projected forward on each side, so as to concentrate the stream in the centre of the river. By reference to the drawings it will be seen that the cornice of the abutments and piers follow the inclination of the roadway, which we consider an improvement in the architectural effect on the ordinary mode of making the cornice and parapet horizontal, as at London, Waterloo, and other bridges.

We will now proceed to describe the construction of the arches. It will be observed that at the springing of the ribs the abutments are splayed or inclined to an angle of 66 deg., and formed of solid masses of stone, on the face of which oval recesses are sunk to receive the abutment plates, and are made a little larger, to prevent the vibration of the bridge splitting the stone off the edges. The abutment plates are of cast-iron, in two pieces, as shown in figures 7 to 13, which were firmly bedded on to the stone with *Pouilly* cement. These plates form a socket for the reception of other plates bolted on to the ends of the ribs. They were firmly connected together, and the joints filled in with an iron cement, composed of 10 parts of cast-iron filings, 2·5 of sal ammoniac, 1·8 of sulphur, and 2·25 of metal dross. All these were in fine powders, carefully amalgamated, and mixed with only enough water to bring them to a good consistence. The weight of each under plate is about 850lbs., and of the upper plates 1220lbs.

In order to unite the firmness of iron with the elasticity of wood, and to insure both against the ravages of the weather, while lightness and cheapness of construction are equally consulted, M. Polenceau has adopted a peculiar form of rib, which has been called, from its shape, the "tubular rib." Each rib is formed in 22 lengths, and composed of two separate cheeks of cast iron, bolted together, with nine thicknesses of timber inside, as shown in figure 19. The interstices between the timber and iron are filled in with a composition of two parts of Seyssel asphalte, and one part of gas tar, which also forms a capping on the top of the ribs. In filling in the asphalte, the ribs were heated by means of portable furnaces, so that an opportunity was afforded of ascertaining the extreme expansion of the metal. The length of the ribs were of four kinds—outer and inner end pieces, and outer and inner middle pieces, varying in size, but were about 13 feet long on the average, and weighed about 2,800lbs. To insure their strength, each half rib was subjected to a double proof, first by suspending it by a fulcrum at each end, and then laying on it 40 tons; and again, by dropping a ton and a half on the middle, from a height of 1, 2, 4, and 6 yards: these lengths fit into each other, and are fastened together by screw-bolts and iron keys, as shown in figures 16 and 17.

Each arch is composed of five ribs, connected together by means of cross ties, bolts, and braces, as shown in figures 2 and 3, and more at large at figures 17 and 18: upon these ribs are placed the rings which carry the superstructure; they vary in size and weight, according to their position. Some of the larger are 10 feet diameter, and a ton and a half in weight; they are united to each other by bolts at their circumferences, as shown in figures 14 and 15. By reference to figure 19, it will be seen how the lower part of the ring rests upon the ribs; and, by figure 4, how the upper part carries the longitudinal bearers: these rings are again connected transversely, by means of bolts across the arch. They required considerable care in setting them, on account of the difference in the size of the arches. Some of them were found too large, and others too small.

The longitudinal bearers or girders consist of two flitches of oak, bolted together, as shown in figure 4: upon these are laid the transverse bearers or joists of oak, which are notched or calked, and bolted down; upon the joists are laid two thicknesses of planks, breaking joints over each other. The lower planks are of oak, and the upper of deal; over these are laid the road materials, and on the sides are flitches of timber, forming a curb and gutter to the roadway; the footpath is also formed of oak plants, raised on longitudinal bearers, as shown in figure 4, with a slip of iron let in flush, the whole length, and iron guards at distances, as shown in figure 4. The exterior of the footpath is converted into a cornice, an iron sunk fascia, being laid over the face of the lower longitudinal bearer, and on the ends of the joists, an iron capping, forming a modillion, with a moulded capping also of cast iron, and the upper part formed into a fascia with a bed molding under the edge of the footpath, the whole having a pleasing effect, as shown in figures 4 and 5. The plankings of the roadway were well rubbed over with tar, and all the joints carefully filled up with sand, and then rubbed with a mixture of equal parts of vegetable and gas tar. The material of the road is composed of white chalk stones and pebbles, the size of walnuts, and the whole surface of the roadway and footpaths finished with asphalte. On each side of the bridge, to protect the footpath, is an iron railing, with bars 7 inches apart. All the iron work of the bridge is painted with an iron grey colour, of M. Polenceau's invention.

We have endeavoured to explain the construction of this bridge in the best manner we are able, and for the better understanding of its details, we refer the reader to the drawings and references which will be found to contain the dimensions of most of the timber.

We are principally indebted for the drawings to our foreign contemporary, the "Algemeine Bauzeitung." We wish the editor of that publication would be as generous in acknowledging the numerous articles that have been copied by him from this journal.

GLENARM HARBOUR.

"The chief ruler or statesman that will be able to form asylum-harbours on the unsheltered and dangerous parts of the coast, and will also cause to be marked or beaconed, by the erection of granite towers, the dangerous rocks, the shoals, and the reefs which surround the shores of these kingdoms, thereby giving safety and security to the mariner in time of tempest and storm; also safety to the floating wealth of these realms, and the colonies thereunto belonging; also lessening the wail of the widow and the orphan throughout this maritime land—will not only receive the blessings of future generations for the erection of these works of mercy, tending so much to the preservation of life and property, but will also increase, to a great extent, the wealth, the power, and prosperity of the whole empire."—*Bald's Evidence on Harbours—Public Works—Ireland.*

Report of WILLIAM BALD, Civil Engineer, F.R.S.E. & M.R.I.A., &c., *on the erection of a Pier, and formation of a Harbour in Glenarm Bay, in the County of Antrim, Ireland.*

The Bay of Glenarm, where the proposed Pier is intended to be erected, is situated on the north-east coast of the county of Antrim, bordering the North Channel. The bay is about half a mile in length, and three furlongs in breadth; containing an area of about 120 acres, and possessing a very considerable depth of water: four, five, and six fathoms. The bottom consists of clay, and is well known to be excellent holding-ground to all classes of ships. At the head of Glenarm Bay is situated the town of Glenarm, and the land surrounding the bay rises to a considerable elevation, and protects it from the prevailing southerly and westerly gales. This bay is, however, open to the channel sea from the north, north-east, east, and south-east; but the greatest run of sea into it is from the north and north-east. The Bay of Glenarm lies nearly opposite the entrance to the Clyde, offering very great facilities to commercial intercourse with all the towns situated on the west of Scotland; viz., Glasgow, Ayr, Greenock, &c. &c. It is distant from Larne 10 miles, and from Portrush nearly 50 miles; so that, in an extent of 60 miles of coast, there is no harbour, either artificial or natural, to afford protection to foreign traders, coasting vessels, or even to the smallest description of fishing craft. These reasons alone are sufficient to prove the great utility that would be derived from the erection of a harbour in Glenarm Bay; and it would, also, give shelter and security to a great portion of the floating wealth belonging to the Clyde, the port of Liverpool, the colonies of North America, and the West Indies, which would pass through the Irish Northern Channel. Besides affording an asylum for vessels overtaken by storm, it would give a port to the whole of the central portion of the county of Antrim, consisting of large districts of country highly cultivated, and producing great quantities of grain, and cattle of all kinds, and which could be cheaply exported, by means of a harbour at Glenarm; and, also, the valuable facility of importing into the country all the necessary articles of merchandize. Glenarm harbour would become the port to an extent of country containing not less than 400 square miles, also to the whole of the fertile interior country adjacent to the large and populous town of Ballymena, distant only 12 miles; and it would offer a ready means of direct commercial intercourse with the manufacturing and maritime districts of the Clyde in Scotland, both by steam and sailing vessels; and which would, in a very short period, create and augment the trade of the country to a very great extent. The Portrush and Derry steamers to Liverpool, touching at Glenarm, would establish a trade of vital importance to the merchants of Ballymena, particularly those engaged in the export of pork, butter, provisions, and linen cloth. The exportation of limestone from Glenarm to Scotland, and the importation of coal in return, would form a very lucrative and highly beneficial branch of trade between the countries. At present there is not more than about 6,000 tons of limestone exported, and only 1,000 tons of coal imported. There can be no doubt but the importation of coal would greatly increase, both for burning lime, and working the steam-engines and machinery in progress of erection at Ballymena and Broughshane, when the facility of procuring this necessary article from Britain is attained, by the construction of a harbour at Glenarm.