boulder stones and gravel, such as is already directed for the filling under the pitching. As regards the additions, or deductions to the contract that may be involved in the alterations ordered in the minute, the Commissioners agree to the proposal made in Mr. MacMahon's letter of the 4th instant, that the portion of the dam which is to be left in the bed of the river is to go in exchange for the sheeting piles and wales dispensed with, and that the bearing piles, sleepers, planking, concrete, pitching, excavation, &c., be calculated according to the quantity contained in them."

Mr. CUBITT, *V.P.*, said, he was one of the Shannon Commissioners, and in that capacity had rendered himself acquainted with the locality and the bridge itself, which he considered a good structure.

Captain W. S. MOORSOM said, he had also seen the bridge, since it had been opened; it was an excellent structure, and he was surprised that the expense of it was so small. It had been said, that the opening arch had not been placed in the most judicious position for the channel; indeed, it appeared from the drawings, that the channel was deeper in another part: it had also been said, that an artificial channel had been created for some purpose; it was, therefore, desirable that these points should be explained.

Mr. WALKER thought, the reasons for the situation of the opening arch and even for cutting an auxiliary channel were very evident. The river was subject to floods, and it would not have been judicious to place piers of the size necessary for the swing bridge, in the middle of the channel; indeed, it would appear, that the piers which were necessarily placed in the stream, impeded it so much, that it was considered prudent to cut a side channel to take a portion of the waters, and through that the navigation was conducted, finding there less resistance in passing the bridge.

Mr. Walker could not approve of the absence of transverse ties in coffer-dams of any magnitude; it would be hazardous and without any commensurate advantage. It would be more important to get rid of inner wales, if possible, as when the puddle sunk from them, leaks frequently occurred.

Mr. W. RADFORD observed, that in such a limited depth of water as only 6 feet, or 8 feet during floods, which was the case at Athlone, through-bolts might be dispensed with in the coffer-dams; indeed, he thought they might have been made of single rows of sheet piling, well driven and close jointed, without puddle; but in coffer-dams of magnitude, such for instance, as those constructed under Mr. Walker's directions at Blackfriars Bridge, it would be dangerous to

have dispensed with cross bolts. Those dams were composed of two rows of whole-timber piles, driven at intervals of 6 feet from centre to centre, longitudinally, and 8 feet apart, transversely, with whole-timber walings, and two rows of half-timber sheet piles, retaining a thickness of 5 feet of puddle, which was carried down to the natural clay. The height from the bed of the river, to the top of the dam, was upwards of 30 feet, and the piles were generally about 45 feet long, yet the dams, when finished, were so perfectly tight, that one labourer, with a hand-pump, kept each of them quite dry. In these dams, the lower tie bolts, which were of round iron 1½ inch in diameter and placed at intervals of 6 feet longitudinally and 18 feet down, were frequently fractured by the pressure of the puddle. In the construction of these dams the utmost economy of material was practised, consistent with the nature of the work.

The system of making the walings was not novel, as it had been used at Blackfriars Bridge, where the wales were sunk to 6 feet below low water, to stiffen the sheet piling.

June 19, 1849.

JOSHUA FIELD, President, in the Chair.

No. 810.—"On the Employment of High-pressure Steam, working expansively, in Marine Engines."* By John Seaward, M. Inst. C.E.

[ABSTRACT.]

THIS communication was described to be the substance of a reply, by the Author, to some questions addressed to several eminent engineering firms, by the Hon. H. L. Corry, M.P., when Secretary of the Admiralty. This reply was found to furnish so much useful information, and so completely to open the question of the advantage, or disadvantage of using high-pressure steam, and of cutting off the steam at various portions of the stroke, that it was conceived it would be advantageously produced at the Institution, in order that the subject should be fully discussed.

The Paper first reviewed the mode of working marine engines, for some years past, and noticed the gradual change that had occurred, particularly the tendency to use high-pressure steam, instead of that of a pressure of about 4 lbs. above the atmosphere. It then examined the system of cutting off the steam at various parts of the

---

* The discussion upon this Paper extended over portions of two evenings, but an abstract of the whole is given consecutively.