Dr. Ure. Dr. Ure said that the part of Mr. Mallet's paper which was most interesting to chemists, was the mode of analysis. This was always a subject of delicacy, difficulty, and labour. His own mode of analyzing cast-iron was somewhat analogous to that which had been described. He took a portion of iron, reduced by filing to a fine powder, mixed it with the same quantity of chlorate of potash, and five or six times its weight of clean siliceous sand, to dilute the mixture: this was heated in the usual way, in a combustion tube with more chlorate of potash, whereby all the carbon contained in the iron was converted into carbonic acid, which was passed through a solution of the sub-acetate of lead, instead of potash water. Carbonate of lead was thus produced, and its amount, when washed and dried, gave the quantity of carbon in the iron operated upon, 134 parts of carbonate of lead, indicating 6 parts of carbon; therefore $\frac{1}{100}$th of a grain of carbon might be detected by this method.

The question as to the state in which the carbon existed in the iron was more difficult of solution. Karsten's mode of determining this point was very delicate and accurate: the pulverized iron was mixed with moistened chloride of silver, which acted upon the metallic iron alone, leaving the carburet of iron untouched, and its amount could thus be determined with great nicety.

With white iron which could not be filed, the chloride of silver was formed into a mass. A disc of it being placed at the bottom of a vessel with a little water over it, the piece of iron was laid upon it; a few drops of muriatic acid were then added, and in eight or ten days the iron was dissolved, leaving untouched the carbon, which existed in the form of graphite.

Mr. C. W. Williams. Mr. Williams agreed in the advantage of preventing the corrosion of iron vessels, but he feared the expense of the mode proposed by Mr. Mallet, particularly as at present, although comparatively unprotected, they were very durable. He instanced particularly the light boats on the river Shannon, which, although constructed of very thin iron, and had been at work between six and seven years, exhibited no signs of decay.

Mr. Rendel. Mr. Rendel said that the durability of iron canal boats was well known. On the Tavistock canal, there now existed some boats which had been employed for twenty-five years in carrying coals, iron, and copper ores, or other goods, and yet they were not extensively corroded.

Mr. Field, V.P. Mr. Field stated, that although in India iron generally corroded rapidly, the iron vessels that had been sent there, did not appear to be affected sooner than in England. He had been informed by Mr. Laird, that the boilers of the 'Garry Owen' iron steamer, had been

renewed twice in nine years, and on every occasion it had been remarked, that although the bottoms of the boilers were entirely destroyed, the iron plates of the hull of the vessel immediately beneath them retained their original coat of paint, and were not at all corroded.

Mr. Jordan suggested the probability of the hull of the vessel being protected at the expense of the boilers, on account of the electric character of the metal being altered by the heat of the boiler, and the general circumstances induced. Mr. Jordan

Mr. Field said that the boilers in question had lasted as long as they would have done on board a timber-built vessel. Mr. Field, V. P.

Mr. Williams corroborated the statement. The boilers had worn out in the regular time, and had failed first in the usual spot, which was the bent plate, where the sides joined the bottom. There was not any thing remarkable in the wear of the boilers. Mr. C. W. Williams.

Dr. Ure thought that the heat of the boilers having probably been sufficient to dry up any moisture from beneath them, might have tended to preserve the hull of the vessel from corrosion in that spot. It was easy to account for a less degree of corrosion taking place in iron ships, or on rails of railways, as long as the former were constantly kept moving, and the latter were regularly travelled over. In these cases any oxydation which took place was rubbed off as it was formed; but if either were in a state of inactivity, the scale of rust permitted an accumulation of moisture beneath it, an active galvanic pile was completed, and oxydation went on with increased rapidity. Dr. Ure.

Mr. Vignoles remarked that the paper did not notice the iron water-tight bulk-heads for vessels, which had been introduced by Mr. C. W. Williams. Their practical utility was now generally admitted, and he believed they were about to be adopted in the navy. Mr. Vignoles.

Mr. Williams said that about nine years since, he first introduced the system of dividing the hull into five compartments, by four water-tight iron bulk-heads, with the intention of their adding to the strength of wooden vessels; but it occurred to him that they would be otherwise useful, and although the ship-builders opposed it, he persevered, and now all the vessels under his superintendence had them. Their value had been proved on many occasions, and by them, the Royal William and several other vessels had been saved. With four bulk-heads it was impossible for a vessel to sink, unless three of the compartments were broken into, which was scarcely possible. Mr. C. W. Williams.

The President believed that the James Watt, which was built at least sixteen years since, had three close timber bulk-heads, intended for the same purpose as the iron ones. The President.

Mr. Williams replied that they would not answer the same purpose as the iron ones, and that if a vessel had only three bulk-heads, mak- Mr. C. W. Williams.

ing four compartments, if one of them was broken into, the vessel would sink, but with five compartments it would be saved.

With regard to the general durability of iron vessels, he recollected an iron vessel being built at the Horseley iron-works more than twenty years since, which he believed was still in existence; and a small boat, built for him by Mr. Grantham, of very thin plates in the year 1824, was still at work.

Mr. Manby, Secretary. The Secretary stated that the vessel alluded to by Mr. Williams, was the 'Aaron Manby,' which was built by, and named after his father in the year 1821. It was the first iron vessel that ever went to sea; it had been very roughly used, and the engines and boilers had been more than once renewed; yet the hull had scarcely required any repairs, and it was very slightly corroded, although it had been severely tried by being used in both fresh and salt water upon the river Seine, for which service it was built.*

It was well known in Staffordshire, that many iron canal boats which were used indiscriminately for carrying coals, iron ore, limestone and other cargoes, and had received scarcely ordinary attention, were upwards of forty years old, and were still serviceable.†

Mr. F. Braithwaite. Mr. Braithwaite said that he had recently heard of the sale of a wooden vessel forty-five years old, which was still sea-worthy, and was capable of being insured.

The President. The President observed, that although part of two evenings had been devoted to Mr. Mallet's paper, yet that such was its value, that it could scarcely be discussed until members could peruse it at leisure, and enter into the wide field of observation which it embraced: it was a paper of undoubted merit, and the attention of the Publica-

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* "Iron as a Material for Ship-building," by J. Grantham, 8vo., London, 1842, p. 6.

† In a letter from Mr. John Laird, dated June 29, 1843, he says, respecting the probability of corrosion in iron vessels, "I beg to state that the following vessels have had their boilers replaced (some of them twice), and that the bottom and sides of the vessels near the boilers have been found quite free from corrosion; in fact, the paint originally put on was almost perfect:—

Lady Lansdowne, built in	1833
Garry Owen	1834
Eliza Price	1836
Duncannon	1836
Duchess of Lancaster	1839

"The Euphrates steamer, built in 1834, has had her machinery taken out, and been converted into an accommodation boat for passengers for the Indus. The hull of the vessel was found quite perfect, free from corrosion, and as perfect and sound as the day she was launched."—Sec. Inst. C. E.

tion Committee had been directed to it by the Council, in order to its general circulation, with the former valuable paper, by the same author, as soon as was practicable.

No. 663. A pair of electro-magnetic signal telegraphs, constructed for the Aix-la-Chapelle railway, from the plans of Professor Wheatstone, were exhibited. Electro-magnetic Telegraphs

Professor Wheatstone explained, that the principle of this signal telegraph, which he considered to be the most efficient arrangement for practical purposes, was the same as his last electro-magnetic telegraph, in which a dial, or hand, was caused to advance by the alternate attractions and cessations of attraction of an electro-magnet, occasioned by corresponding alternate completions and interruptions of the circuit, by means of a peculiarly constructed apparatus, placed at the opposite end of the telegraphic line.

The present signal telegraph was intended for the use of the inclined plane on the railway at Aix-la-Chapelle, where only a limited number of signals were required; the entire alphabet of the complete telegraph, was therefore dispensed with, and the instrument was restricted to six elementary signals. The letters M, S, C, T, B, &c., on the face of the dials were the initials of the German words for engine, rope, train, telegraph, &c. The dial was eight inches in diameter, and the characters were conspicuous, so that they might be readily seen at a distance; the hand, which was required to be made very light, and to keep its form, was of blackened mica. The cross being reserved to indicate the quiescent condition of the apparatus, there remained five available characters, which, combined two and two, gave twenty-five signals—a number amply sufficient for the purposes of the railway. It being established as an invariable rule, that each signal should consist of two characters followed by the cross; were the telegraph to act in any way irregularly, the index would, at the end, point to some other character, instead of the cross, and this would indicate that the preceding signals were wrong, so that if the signals received, should not correspond with those sent (which, however, could not be the case if ordinary care was taken), no mistake could possibly arise, because they carried with them the evidence of their error. The instruments were furnished with a simple means of bringing the hand immediately to the resting point, without interfering with the circuit. As it might be occasionally required to transmit a permanent signal, which should remain, until a person arrived to inspect it, the five simple characters could be employed for this purpose.