DISCUSSION.

Mr. H. Kidd said he had moved the adjournment of the discussion at the last meeting as a matter of form, for the purpose of giving the shipping people an opportunity of discussing the paper, as he had not had much experience in the direction indicated in the author's paper. The author had put before them very clearly the various causes of deterioration of ships, but he had not mentioned the better ventilation of the holds and engine-room, so that these portions might be kept free from excessive moisture. He also pointed out the influences of a hot climate, as borne out by his experience in Fiji, where they had tried coating the top plate of the punts with tar, but it had blistered off very quickly indeed. On the Richmond and Clarence, where they also used tar on the punts, where the timber was fairly decayed after about fifteen years, the angle irons and gusset plates were nearly as sound as the day they were put in. As an evidence of climatic influence, they had been compelled to clean off the tar in Fiji, where they had also applied it to the punts, and they now had to paint them very frequently, and in less than a month the paint blistered. The author had laid stress upon the value of accessibility to the various parts of the ship, and he believed all engineers admitted that. With regard to tanks under boilers, some two years ago, they had to renew a tank so placed, and they found it very badly corroded. In a recent report from the Institution of Civil Engineers, it was stated that the cause of corrosion was that when the tank was empty, the water splashing about struck the top plates, and in rising from a temperature of 70 deg. to 100 deg. gave off chlorine gas, hence the deterioration.

It was a question of the heat from the boilers and pipes, and they had lagged them with asbestos and Muntz metal. It meant either lagging the bottom of the boilers or keeping them as far from the top of the tank as possible. They had used zinc paint, mixed with turpentine, and after six months use, although subject to the variable temperature of the furnace, the paint was still on the plate.

Mr. R. Pollock said when tanks under boilers were devoted to carrying fresh water, they seemed to deteriorate much quicker than when carrying salt water. The author referred to the matter of rigidity, and the shafts being out of line, he (the speaker) thought sufficent consideration was not given to this point. Racing was a legitimate consideration in the construction of shafting. He mentioned a case which occurred about three years ago, where the tail shaft had been about the same diameter as the crank shaft, and they had bored out the stern tube, put in a new bush, and had had no trouble since.

Mr. W. H. German remembered reading of a remarkable case of corrosion in a steamship, printed in the third volume of the 1896 papers of the Institute of Mechanical Engineers. There was a steamer of 800 tons, carrying a cargo of ore, which was submerged for six days. In this case, it was fairly well proved that the ore in contact with the salt water, set up a chemical action, that had a dissolving property on iron. The wrought iron was corroded to a depth of 3/32in., and the cast iron to $\frac{1}{8}$ in.

Mr. J. Thomson detailed his experience in the running of steamers, and the depreciation of the boilers by the excessive use of fresh water. They used fresh water, which could not have had very much foreign matter in it, as it was really melted snow. They found the boilers corroded considerably, and the use of fresh

water was altogether abandoned, and salt water was substituted, and the use of condensers. The boiler pressure was from 60 to 75 lbs. With reference to zinc plates, some of the boilers never had zinc in at all, and others had. Those with the zinc had to have the supply kept up, otherwise the corrosion commenced again, but boilers that never had zinc in at all didn't seem to suffer for the want of zinc plates.

Mr. Kidd said that they had used caustic soda with the water, and that saponified it, so lime was substituted, and the water was quite clear. They now tested the blow-off water as well as the feed, for the purpose of seeing whether it was alkaline or acid. It was possible to be alkaline on entering, and the precipitate might lie on the bottom of the boiler, but by taking care to see that the water blown off was alkaline, all risk in that direction was prevented. The President said that judging from Mr. Pollock's remarks, regarding shafts, engineering practice was tending in the right direction, for a remedy for some of these shaft failures. Where the thickest part of the shaft was held in position by the stern bush, the racing together with the corrosion must cause a great deal of fatigue, and the chances were that the increased size of the shaft would tend to minimise the fatigue. A cause of trouble at Eveleigh was the question of corrosion in boilers, and it was a very sore point so far as the speaker was concerned. With locomotive boilers there was no opportunity of putting in zinc plates. Of course, they might be put in when the locomotive was building, but it was another matter of getting at them when there came the necessity for renewal. With regard to pure water they had had a great deal of trouble with Sydney water in some of the boilers, running particularly in the metropolitan district. He referred principally to those built of steel.

Mr. McAllester, in reply, said that no doubt ventilation was practically neglected altogether in the matter of holds, bunkers, and tanks, with the exception of the ordinary atmospheric influences, and advocated a complete system of constant cross ventilation in the confined spaces of a ship, and its more frequent inspection, by means of easily removed and replaced covering of confined spaces. With respect to bunkers and the corrosive effects of the coal, there was nothing that he knew of to prevent this. It was almost impossible to get coal perfectly dry. And the iron pyrites when confined with the moisture in the bunkers formed sulphuric acid, and as the coal abraded the paint that covering in bunkers was absolutely useless. Another objection with present vessels was the shape of the sections. Constructors seemed to stick to angle and bulb irons almost as a matter of convenience, and, perhaps, force of habit. As regarded the scantling of steamships it was not a convenient section, because it was almost impossible to clean it. When the lining of a ship was put in on its present form, it was not often taken off for inspection purposes—such a process cost too much, and, furthermore, in its removal the lining was often broken. If the frames were made of, say. single flange bulb irons, a reasonable amount of rigidity would be given to the ship. Another matter was the convenience of the sparring for removal, instead of being bolted, it should be fitted in cleats. Mr. Pollock had referred to the deterioration of ballast tanks when fresh water was carried. This was borne out by the speaker's own experience. He was in a vessel for about five years, and during that time there was not an ounce of salt water in the tank. And they found that, nevertheless, the deterioration went on. It appeared that the exception was when it was subject to alternations of temperature. He did not think it

was possible to have the water in the boilers too pure. He believed the trouble in most boilers, in the matter of corrosion, had its genesis in the periodical lying-ups. Sometimes a vessel was laid up for, perhaps, three months in the year. For instance, his company had a dull season of five or six weeks, and instructions to lay up were sometimes accompanied with the statement that the vessel might be wanted next week. The doors were taken off, and 3 or 4 inches of water were left in the bottom of the boiler, and then the trouble commenced. The best course was, instead of taking the doors off and leaving the boiler empty, to put the doors on again when it was empty.