

that the difference has to be paid in hard cash, or in what passes for its equivalent in London or New York. quite another face is put upon the matter. If other countries are willing to keep on giving us every year at the rate of three millions' worth of their goods for two millions' worth of ours, or five for four, and call the transaction square at the year's end, we shall not owe them anything, there will be no balance of debt accumulating against us. But if the odd millions have each and every year to be settled by bills payable or by government or municipal bonds and debentures, the case is very much altered indeed. Never mind the apparent balance of trade; at all events do not take that alone as the basis of your calculations. But fix your attention on the *balance of debt*, which is the main point of all. Is yours a creditor or a debtor nation? If a debtor nation, is its debt abroad increasing or diminishing? Ascertain that beyond all doubt, get a reliable estimate of the gross amount of foreign debt, and of its increase or diminution from time to time, and then you have the key to the situation. Such was, in substance, the explanation of the question given some years ago by Mr. Hague.

The bearing of all this on the protection and free trade controversy is quickly seen. England's imports have long exceeded her exports, and yet for commercial prosperity and money-making she leads the world. Therefore, say the free traders, the adverse balance of trade idea is a bugbear to frighten timid people, and the talk about manufacturing at home and keeping the money in the country is all "bosh." But if it be shown that the real balance of debt and not the apparent balance of trade is the thing to be looked at, then the tables are turned against the free traders. For in such case it is evident that what would be the right conclusion as applied to a creditor country, would be all wrong if applied to a debtor country. If Canada, for instance, goes in debt for the means of building great public works, we may have value received, aye, even more than the nominal value, to show for it, in the works themselves and in the growth of the country which they have promoted. But to the extent that our debt abroad stands for things that perish with the using, for articles of extravagance and luxury, or for necessary articles which we might have produced at home, but did not, we have absolutely nothing but experience to show for the debt which stands against us.

Directly the "balance of debt" article appeared in the *Witness*, a writer in the *Toronto Mail* took up the theme, and showed that if this were the true theory, then the free trade theory of the balance of trade must be wholly and fundamentally wrong, as applied to Canada. Canada being a borrowing country, a debtor country and not a creditor one, the inference was obvious. The *Witness* was challenged to reconcile its own free trade views with the true theory of the balance of debt, so ably set forth by the writer of its financial articles. To that challenge *there never was any reply* on the part either of the *Witness* or any other free trade paper. And we venture to say that there never will be any, from that side of the controversy. The same writer has on several occasions since presented the "balance of debt" explanation of the old difficulty, being careful in every instance to give credit for it to the writer in the *Montreal Witness*, of whose identity, however, he was not informed until it was made public a few weeks ago. We hope soon to hear what Mr. Hague has to say, further, on a problem with regard to which he has already given us the true opening.

STEAM BOILER MANAGEMENT--WHAT IS PRIMING?

In nearly all new boilers, when first put to use, the water is found to act in a very troublesome way. It will apparently rise up in the boiler, and sometimes be so violently agitated that it is impossible to tell with any degree of accuracy what height the water is in the boiler. The glass water gauge of ordinary construction is almost useless in such an emergency, and the test cocks are equally unreliable, as at one instant steam may blow through the top gauge while at the next moment solid water comes rushing out. The danger of injury to the boiler, from the attendant being deceived as to the amount of water in it, is not the only one, as frequently such quantities of water are carried over into the cylinder of the engine as lead to serious breakage of the steam chest or cylinder.

The cause of a new boiler priming is usually considered to be the presence of an unknown amount of grease or oil on the plates or tubes, and after this has boiled off and the plates either become thoroughly cleansed or sealed over with a little deposit, the difficulty usually ceases.

Sometimes, however, it continues and becomes a very serious drawback to the successful working of the boilers and engine, as well as causing a considerable loss of fuel.

One very remarkable case of priming occurred with the boilers of H. M. S. *Serapis*, which took the Prince of Wales to India, in 1875. Eight new boilers had been placed in the vessel, and all the machinery overhauled to prepare her for the voyage to India and back. On attempting to make a full speed trial at Portsmouth, priming occurred to such an extent that the trial had to be abandoned. On the voyage to Malta the trouble continued so that two boilers were disabled and had to be repaired at Malta. Baffle plates about 3in. above the normal water line were placed in several of the boilers, and in two of them planks of wood were placed to float on the surface, and were fixed with guides to keep them in place. But little improvement was found to have followed these alterations, and in one of the Indian ports they were all removed. At Calcutta the boilers were all cleaned and filled up with fresh water, and with one exception no further trouble was experienced. The best skill at the command of the English navy was called in to remedy the difficulty in this case, and yet it all failed, and priming continued until a scale had formed on the plates and tubes.

Boilers which are so small for the amount of steam required that the fires have to be unduly forced, are very apt to "prime." In this case it is probably due to the violence of ebullition, throwing particles of water up into the steam space, where they are caught by the current and carried on into the steam pipe.

The question as to what volume of steam space should be allowed in a boiler as compared with the volume of water, and extent of heating surface, is one on which there are wide differences of opinion among engineers and boiler-makers.

No doubt if the surface of the water be close to the steam outlet, there is a likelihood of more water being carried into the steam pipe than if the distance were greater, but just how far below the outlet it should be, and whether or not mere vertical distance be sufficient, are points which are still among the unsettled matters in steam engineering. A common old-fashioned rule was that the total vertical depth of the boiler should be divided into three parts, and that two of these