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No. 551.

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TORPEDO BOATS IN THE GALE.

The report sent hither from Washington to the effect that the recent loss of torpedo boats sustained by the French is creating serious distrust in such vessels, and is likely to affect the torpedo movement here, can scarcely be founded upon anything more substantial than rumor. Surely no sailor or naval constructor would condemn the use of the torpedo boat for harbor and coast defense because it could not outride the gale. The torpedo boat, as designed for use here, is not a cruiser, and not likely, even in active service, to be called upon during storms. In harbors, which she is designed specially to protect, she can always find a lee to run under.

Nor should it be inferred, from the dispatches referred to, that the modern torpedo boat is unseaworthy. On the contrary, she has shown her capability to take to the high seas under the ordinary prevailing conditions of tide and wind. The recent storm in the Mediterranean was of unusual fierceness, and was greatly intensified in its destroying power off Cape Corsica, where the torpedo boats were lost, by the set of the tide, which was athwart the wind; that is to say, at right angles to the direction whence the wind was blowing.

The *Admiralty and Horse Guards Gazette* says:

"A force of eighteen torpedo boats left Bastia for the purpose of assisting in the attack on the squadron at anchor in the Bay of Ajaccio. A stiffish breeze was blowing and the sea was a bit loppy, but the weather was not sufficiently rough to interfere with the regular arrival of the packet boats at Corsica. Of the eighteen torpedoers that accompanied the men-of-war, only six got around Cape Corsica and of these only two were in such a state as to prevent their taking part in the attack before making repairs. One was patched up, so five torpedo boats engaged in the operation upon which so much interest centered. All the second and third class torpedoers had been compelled to put back, those which got round being boats of the first class. It is said that only two men among the crews of the six boats escaped seasickness."

Regardless of such instances of impotency on the part of the torpedo boat, it must continue to be at least a valuable auxiliary in the defense of harbors. Indeed, a torpedo boat which has cost but $100,000 or less may, under favorable conditions, destroy a modern steel monster which has cost three or four millions. Those interested in this matter will remember the brilliant affair in Chinese waters, during the recent Franco-Chinese war, when a well handled torpedo boat sunk the Chinese flagship Yung-Wo without losing a man.

Indeed, it is by no means certain that a fleet of great leviathans, like the English Devastation, the French Imperieuse, and the Italian Dandolo, could, with all their great guns in play, safely pass a fleet of a score of modern torpedo boats. A target moving as fast as the best torpedo boat, viz., 22 nautical miles an hour, is not easily hit, and, when the smoke of battle covers the waters, not readily seen.

More attention is being given to the torpedo boat to-day than to the war ship, and because of its effectiveness and cheapness, it is not strange that this should be the case.

THE BASIC STEEL PROCESS.

Among the several modifications of the pneumatic, or Bessemer, steel process which have been brought forward during the past few years, none has proved of such large commercial importance as that introduced by Messrs. Gilchrist and Thomas, and known generally as the "dephosphorization," or "basic," process. Though comparatively a recent invention, it has met with a wide application in Europe, both on the Continent and in Great Britain. In America, the plentiful supply of rich hematites and magnetites practically free from phosphorus has somewhat delayed its introduction, since provision for dephosphorization is less a necessity here than abroad. But the higher price of non-phosphoric pig iron, or Bessemer pig as it is denominated in the metal market, together with the perfection to which the basic process has now been brought, makes it a desirable addition to the steel industry of this country as well as to that of less favored districts. As yet the only basic "plant" in America is that just erected at Pottstown, Pa., by the Pottstown Iron Company. The first blow of basic steel was made on July 1, and the product obtained was in every way satisfactory.

Though there are a number of minor differences between the Bessemer and the Gilchrist-Thomas processes as regards the design of the converter and its subsequent manipulations, the essential difference between the two is in the lining. In the typical Bessemer vessel, no provision is made for the removal of phosphorus from the metallic bath, and therefore none but the purest brands of pig iron are available. The lining is entirely acid, being composed of ganister, a silicious rock in which the silica is held together by a small quantity of argillaceous material. The reactions occurring in such a converter are therefore limited to the oxidation of the silicon, carbon, and manganese, while the greater part of the phosphorus contained in the pig iron remains combined with the resulting steel. In the Gilchrist-Thomas process, on the contrary, the lining is composed of oxides of the alkaline earths, and is therefore strongly basic. The converter employed is very similar to that used in the acid process, and in some cases is identical, but in the best practice certain modifications are introduced, on account of the much more rapid destruction of the basic lining. The movable bottoms and interchangeable parts of the vessel are of even greater importance here than in the Bessemer; while the mouth of the converter, instead of being inclined to one side, is preferably wide and straight, in order that the charging and discharging may be on opposite sides, thus equalizing the excessive wear. The success of the basic process is largely dependent upon the proper preparation of the lining of the converter. Besides being strongly basic, it must be sufficiently refractory to resist extremely high temperatures. The material generally chosen for this purpose is dolomite, a magnesian limestone. This is either manufactured into bricks, which are then cemented together by anhydrous tar, or else it is burnt and ground, and then rammed into the vessel, with tar as a cementing material. The bottom of the converter is about two feet thick, and is formed of the same material as the rest of the lining. The blast holes, or tuyeres, are made by allowing rods, half an inch in diameter, and of sufficient length to reach entirely through the finished lining, to project upward from the bottom plate. When the plate and rods are withdrawn, the necessary openings are left for the entrance of the blast. The manipulations of the basic lined converter are quite different from the Bessemer, and the reactions distinctly characteristic. The charge, varying according to the size of the converter from 7 to 15 tons, is composed of highly phosphoric pig iron, low in silicon. At the celebrated iron works at Creusot, France, a pig iron is used containing from 2·5 to 3 per cent of phosphorus and 1·3 per cent of silicon. The most suitable irons for the basic process contain only 0·5 to 1·0 per cent of silicon, merely a trace of sulphur, and from 1 to 3 per cent of phosphorus, the higher proportion of the latter constituent being, however, preferred.

The converter, having been carefully heated, well burnt lime, free from silica, and in amount equal to about one-fifth of the subsequent charge of pig iron, is introduced, and by means of fine coke brought to a bright glow. The phosphoric pig iron is then added. Air under a pressure of 25 pounds is turned on, and the vessel brought to a vertical position. The blow lasts about thirteen minutes, in some localities longer, and is divided into two distinct periods, the Bessemer, or blow proper, and the after-blow. The ordinary blow terminates in a little over eleven minutes at the basic plant in Westphalia, Germany.

The silicon is first oxidized, and then the carbon. In the acid lined vessel it is seldom possible to effect a total elimination of the silicon, except in the Clapp-Griffiths converter, but it is characteristic of the basic process that the resulting steel contains no silicon, or only the merest trace. But very little phosphorus is removed during the blow proper. It is during the so-called after-blow that the reaction takes place upon which the invention of Messrs. Gilchrist and Thomas depends. The temperature rises at the close of this period to about 1,800° C. The phosphorus is rapidly oxidized to phosphoric anhydride, and combines with the lime added to the charge to form a phosphate of calcium, which is not subsequently reduced. In order to remove as much phosphorus as possible, it is necessary to keep the slag very basic; and consequently, when the silicon in the pig iron much exceeds 1 per cent, it is best to treat the metal by the "transfer method," in which the amount of silicon is first reduced in an acid lined converter, and the metal then transferred to one with basic lining for the after-blow. For otherwise the large amount of silicon would increase the slag, and not only more rapidly destroy the basic lining, but prolong the time required for a blow by hindering the basicity necessary for the removal of the phosphorus.

There is, however, a minimum percentage allowable as well, for in the absence of silicon the metal would become chilled, as it is the oxidation of this element which produces a large proportion of the heat of the reaction. The high temperature obtained in the after-blow is due to the combustion of the phosphorus. By oxidation to phosphoric anhydride it affords 5,747 heat units, and performs very much the same function during this part of the process that the silicon does during the blow proper. The slags produced in this process are almost double in quantity those produced in an acid lined vessel. Average specimens contain about 10 per cent of silica, 10 to 15 of phosphoric anhydride, 10 of oxide of iron, 40 to 50 of lime and magnesia, and varying amounts of manganese. It has recently been proposed to utilize these phosphatic slags in the manufacture of fertilizers, and the proposition is now carried out on a commercial scale in both Germany and England.

The elimination of the phosphorus seldom requires more than about two minutes. When it is judged to