

rolling mills, forges, machine shops, etc., the power produced by the gases in excess of the furnace requirements is directly available for the other mechanical operations, thus enabling such plants to compete, so far as power cost is concerned, with the great hydraulic power installations which depend on natural sources of energy.

"The matter seems to be passing well out of the hands of the investigators into those of the constructing engineers. It is now the turn of the engine builders to produce large gas engines, especially adapted for use with lean gas, and suited for continuous heavy duty, and the part of energetic iron masters to take active steps to introduce the new system. Already, it is reported, a blowing engine to be operated by gas power is being designed for the Cockerill Company, and others should not be slow to follow."

From all that has been said above, it seems safe to conclude that the difficult pioneer work involved in the careful study of the conditions of the problem has been accomplished with results which should prove of the high importance.

HOW SHOULD BOILER-HEATING SURFACES BE CALCULATED.

In a paper lately presented to the American Society of Mechanical Engineers, Mr. C. W. Baker questions the correctness of the usual practice of computing the horse-power of steam boilers from the heating surface. He affirms that by the method usually followed, there results an error of from 7 to 17 per cent., which, he says, is due to the practice of taking the surface in contact with the water, instead of that in contact with the fire gases, as the heating surface. Where these surfaces are flat, there will be no difference between one side and the other, but the boiler-heating surface is made up largely of tubes, and in these there is a difference of 17 per cent. between the interior and exterior surface in the case of a 1-inch tube, and of 7 per cent. in the case of a 4-inch tube.

The error to which Mr. Baker calls attention lies in the failure to appreciate the fact that the heating surface of the boiler, on which its steaming capacity depends, is the actual surface exposed to the fire or fire gases. With clean metal, the actual difference of temperature between the two sides of a boiler plate (or tube) is never more than 1° F., and Lord Kelvin has observed that for all practical purposes, we may consider that the heating surfaces of boilers conduct heat as though they were no thicker than paper.

It follows from the foregoing observations that the temperature of the heating surfaces of steam boilers is that of the wet side and not that of the fire side of the plate (or tube).

Although this fact is common knowledge among engineers, Mr. Baker claims that it has been generally overlooked by engineers and writers on engineering subjects, who have not insisted as they should that the fire side of boiler tubes should be that from which heating surface should be computed.

He illustrates his argument by the statement that if the fire side of the tubes be increased by forming ribs upon it—as is the case with the *Serve* tube—the steaming capacity of the boiler is thereby increased; but no such increase of steaming capacity will result from the placing of ribs on the wet side of the tubes.

Mr. Baker further makes the interesting statement that a thin coating of scale on the wet side of a boiler plate affects the steaming capacity less than a furring of soot on the fire side, which will be something of a surprise to most engineers. Another deduction of the author is that circulation of water in a steam boiler is of much less consequence than is generally supposed in its relation to efficiency. Good circulation is desirable because of its influence in assuring the equal heating of all parts of the structure, and hereby preventing undue strains in certain parts, but in Mr. Baker's judgment, it can have no effect on economy or efficiency.

The points made by the author seem to be well founded, and should receive the serious attention of steam engineers. W.

BOOK NOTICES.

Distribution de l'Energie par Courants Polyphasés. Par J. Rodet, Ingenieur des Arts et Manufactures. Paris: Gauthier-Villars. 1898.
[Distribution of Energy by Polyphased Currents. By J. Rodet, Engineer of Arts and Manufactures. Paris: Gauthier-Villars. 1898. 8 vo., pp. 338, with illustrations. Price 8 francs.]

This work treats of all branches of the subject of polyphased currents with satisfactory thoroughness.

The several chapter heads embrace the following themes: History, treating of the general principles involved in the production of two-phase, three-phase and polyphase currents, and the principles of construction of motors for currents of these types; line construction and the consideration of the phenomena occurring in distribution; transformation of polyphase currents; motors; meters; and finally, the description of the notable installations for the transmission and distribution of electrical energy by polyphase currents.

W.

Kosten der Krafterzeugung. Tabellen ueber die Kosten der effectiven Pferdekraftstunde für Leistungen von 4-1000 P. S., bei Verwendung von Dampf, Gas, Kraftgas, oder Petroleum als Betriebskraft. Aufgestellt von Chr. Eberle, Lehrer an der Kgl. Maschinenbauschule zu Duisburg. Halle a. S.: Verlag von Wilhelm Knapp. 1898.

[*Power Costs.* Tables of cost per effective horse-power hour, for duties ranging from 4-1000 horse-power hour, with the use of steam, gas, producer gas or petroleum as the source of power. By Chr. Eberle, Instructor in the School of Machine Construction in Duisburg. Halle a. S. Wm. Knapp, 1898.]

This publication is a valuable compilation, made from German data, of the comparative costs of the several typical forms of power generators included in the class of heat engines, and cannot fail to prove extremely useful for reference by engineers. The tables embrace the performance of stationary steam engines with saturated and super-heated steam, locomotive engines, gas motors, producer-gas installations, and petroleum motors.

The tables are arranged to exhibit in order the costs of installation, yearly costs of operation, and costs per effective horse power hour. W.