From Liverpool to points in the Far East where the distance is the same, the Tehuantepec Railroad would charge the Suez tolls, which are approximately $2 per ton, and compete for the business with a fair profit.

Turning to the ports, however, in the United States, the advantages given by this route are also remarkable. From New Orleans to Hong Kong the saving would yield the Tehuantepec Railroad $4.80 a ton on the basis of equivalent charges by the Suez route, in addition to saving from twelve to fourteen days in time.

From New Orleans to Yokohama the saving over the Suez route would be 8,400 miles, which would enable the Tehuantepec Railroad to charge $8.40 per ton for the transit of freight on its railway on an equivalent basis with Suez, and save approximately 24 days in time.

From New Orleans to Australia, the port of Sydney, the figures would be practically the same. As there is little question of the ability of this railroad to handle freight from ship to ship for $2 a ton or less, its ability to build up an enormous business to the Far East in competition with the Suez route is plainly manifest.

Let us now compare the Tehuantepec route with that of the Panama Canal, on the same assumption that $1 per ton will carry ocean freights 1,000 miles, and that $1 per ton will be the minimum rate charged for transit through the canal.

From Liverpool to Hong Kong, the saving in distance via Tehuantepec will be 1,200 miles, and allowing two days for the transit of the freight across the Isthmus of Tehuantepec, the saving of time will be approximately two days. The saving in distance will be equivalent to $1.20, which, added to the minimum charge of $1 through the Panama Canal, would give $2.20 as a maximum charge to the Tehuantepec Railroad.

From Liverpool to Yokohama the saving, as against the Panama route, will be 1,100 miles. From New York to Australia, port of Sydney, the saving will be 761 miles, which, on the same basis as just stated, would yield the Tehuantepec Railroad a maximum charge of $1.76 a ton, or approximately 1 cent per ton per mile some 40 per cent. higher than the average rate on the trunk lines in the United States.

From New York to San Francisco the saving will be approximately 1,200 miles, which would yield $2.20 as a maximum rate to the Tehuantepec Railroad.

From New Orleans to Hong Kong, a common point for northern China, the saving of the Tehuantepec line over Panama is approximately 2,000 miles, which would permit the Tehuantepec Railroad to charge a maximum of $3 per ton on an equivalent basis, and save in time approximately five days.

From New Orleans to Australia, port of Sydney, the saving would be approximately 1,400 miles, allowing the Tehuantepec Railroad a maximum charge of $2.40.

From New Orleans to Honolulu the saving would approximately be 2,000 miles, permitting the Tehuantepec Railroad to charge a maximum rate of $3 per ton.

From New Orleans to San Francisco the saving in distance via the Tehuantepec route would be 1,800 miles, permitting the Tehuantepec Railroad to charge a maximum of $2.80 a ton, with corresponding saving of several days in time. The advantages of Tehuantepec over the Suez and Panama routes in the saving of money and time make it self-evident that in the years that will elapse before the completion of the Panama Canal our British cousins will undoubtedly build up a large and profitable business which it will be difficult thereafter to divert back to the Panama route.

Such, briefly told, is an account of the building of one of the most remarkable railroad enterprises in the world. That the work was done by British Engineers, is a matter in which every citizen of the Empire can take pride. And not only is the achievement worthy of attention from an engineering standpoint; but its commercial possibilities in the interests of all parts of the British Empire, are manifest; for it should not be forgotten, that this railway until 1953 (47 years) will be under the control of British capitalists, viz., S. Pearson, & Son, Limited, who are the administrators and managers of the "National Railroad Company of Tehuantepec."

THE ELECTRIC FURNACE: ITS EVOLUTION, THEORY AND PRACTICE

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Article IV.

Electric Furnace Design, Construction and Operation.

An electric furnace consists essentially of some substance R, (Fig 21), through which an electric current flows, and of an envelope C, which retains the heat and the contents of the furnace. Carbon electrodes, A and B, are usually needed to convey the current in and out of the furnace. If the envelope could be made perfectly heat tight, and if no fresh charge were introduced during the operation, it would be possible to obtain any temperature in R up to the volatilizing point of the contents of the furnace, with the smallest electric current, provided it were allowed to pass for a sufficient length of time. With the materials actually available for furnace construction this is not possible. For a definite size and construction of furnace, a definite rate of heat production will be needed in order to attain any particular temperature.

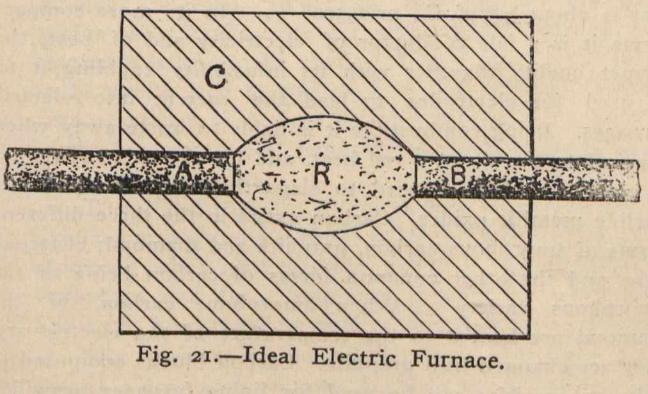

Fig. 21.—Ideal Electric Furnace.

The rate of production of heat is measured by the number of Watts supplied to the furnace, and may conveniently be stated in Watts per cubic inch, or Kilowatts per cubic foot of the interior volume of the furnace. The rate of heat production which is necessary to enable a certain temperature to be attained, may be calculated from a consideration of the area, thickness and conductivity for heat of the walls of the furnace; but it is more easily obtained by reference to furnaces of similar construction which have attained definite temperatures with definite consumption of electric power.

The above considerations apply more particularly to an intermittent furnace such as the Moissan, or Stassano furnaces, in which a charge of ore or metal is submitted to the heat of the electric current until it has all been reduced or melted, and the whole of the furnace and its contents has been heated to a uniform high temperature. In the case of a continuous furnace, such as the Héroult furnace recently employed to smelt iron ores at Sault Ste. Marie, a constant stream of cold material enters the furnace, and after reduction and fusion, is tapped out as molten pig and slag, only a portion of the contents of the furnace being heated at any one time to the smelting temperature. In such a furnace the temperature attainable is limited by the melting temperature of the charge; any increase in the rate of heat supply will serve mainly to increase the rate of smelting, without materially increasing the temperature of the furnace. It is like melting ice in a pail, the ice melts faster on a hot day than on a cool one, but the water surrounding the ice will not become warm as long as there is any ice left to melt. Even in such a furnace the charge must ultimately be heated to the smelting temperature, and a definite rate of heat supply is needed if the furnace is to smelt at all.