I propose in this brief memoir to demonstrate the possibility of an industrial revolution in the United States with regard to the manufacture of cast iron, iron, and steel.

A few historical considerations must first be presented. It is universally known that iron was at first manufactured exclusively by means of charcoal with apparatus of small dimensions. This method precluded the preparation of large quantities, and it became quite insufficient when the introduction of steam-engines gave to industry so much wider a field. The immense importance of coal began to be recognised, and iron was manufactured by its means, according to new methods, which favoured its more rapid production in greater quantities.

A rivalry thus commenced between coal foundries and those kept up by wood, in which the latter were evidently to be overcome. The nations possessing great coal districts, particularly Great Britain, became the producers of iron for all the rest.

In these circumstances, if suddenly there should be discovered a new means of making iron with wood as rapidly and as economically as it is done at present with coal; if, besides, the iron thus prepared should offer in quality very great advantages in comparison with that made with coal; is it not natural to suppose that the consumers who are only attracted by the cheapness of English iron, would cease to employ it? Even admitting that under certain circumstances this iron would be dearer, they could more advantageously use it for those purposes for which iron of the first quality is indispensable, such as the manufacture of steel.

The country best situated for the success of this industrial revolution is undoubtedly the United States of America. For example, wood is found there in great quantities, and may in some places be obtained at a very low price: on the other hand, the beds of mineral iron are very numerous; modes of transport, always important in the working of iron, exist in great numbers. Here we find all the conditions necessary to success; it remains only to establish with certainty the advantage of this new method of manufacturing iron, and to explain its high importance.

1st. Wood is not charged with those mineral substances which injure at once the calorific effect and the quality of the metals fabricated by it. Coal contains often ten per cent. of matters either useless or injurious. Wood, on the contrary, contains hardly one-half per cent. of mineral substances, which besides are never injurious. All wood has great chemical uniformity, while coals differ much from each other, which involves the disagreeable necessity of ranging the methods of employing them. It is well known to metallurgists that wood should not be employed as a combustible without previous preparation, on account of the large proportion of water which it contains.

For many years the most various experiments have been made to prepare the wood before using it as a combustible. The method to which we would now call attention has been used for a short time in Styria and Carinthia, which consists in taking from the wood only the water, and stopping the distillation as soon as the substances which begin to escape contain carbon. Two methods have been used to effect this conversion of wood into *ligneux* (lignum).

1st. The gases coming from the fire-place are brought into immediate contact with the wood; thus the wood is raised to a temperature above 100° Centigrade, which favours still more the vaporisation by the tendency the gases themselves have to be saturated with vapour.*

In the second method, only the heat radiating from the gases in the fire-place is employed. These gases are not brought into immediate contact with the wood, but are conducted in pipes of cast or sheet iron, around which the wood is piled.

This second method affords by far the most satisfactory results, being the more economical, and avoiding the disadvantage which sometimes attends the first, of making the *ligneux* pyrophoric, and thereby liable to spontaneous combustion on exposure to the air.

It is important to render the second method still more perfect. The following means might be advantageously employed:—The combustion of the wood employed effects the conversion into *ligneux*, which is thus raised to a temperature of 150° Centigrade. All the water contained in this wood escapes in vapour; but the heat contained in this vapour and in the *ligneux* should be made useful, as well as the latent heat contained in the vapour. For this three successive chambers will be necessary. The wood loaded on waggons, passes in succession from one chamber to another. In the first chamber the wood will begin to be heated and to dry by means of the latent heat of the vapour, disengaged in the second, and condensed in the third; and also, by means of the latent heat of the air, cooled in the third, and brought back to the first. It is in the second chamber that the entire conversion of the wood into *ligneux* takes place; the *ligneux* will pass into the third chamber to cool; the heated air will be conducted to the first chamber to heat another load of wood; the vapour which is found there, and which comes overheated from the second chamber, will be condensed, and thus will give more heat to the first chamber, with which it communicates by pipes.

In following the preceding method, it is possible to change 10 parts of wood (standing for 1·00 of *ligneux*, 0·40 of water) into *ligneux*, by means of one part of wood employed as a combustible.

There is another method more economical which might be employed to convert the wood into *ligneux*. It consists in utilising the wasted flame of the metallurgic apparatus, after having of course previously used it for other purposes; for example, heating the cauldrons; because on coming from the apparatus the gas is of too high a temperature for the operation in question, and is still sufficiently hot after having been employed for the previous processes. But this method, by which economy is carried to the utmost extent, though very suitable in France or Germany, does not seem necessary in America, on account of the cheapness of the vegetable combustible.

Thus far we have only explained, and very briefly, the first part of the new method of manufacturing iron. We now come to the second part, which is the *puddling process* with *ligneux*. The puddling, it is well known, is effected by burning in a reverberatory furnace the combustible gases which come from a lateral fire-place. The important part of the operation is to conduct into the furnace a sufficient quantity of air to produce a total combustion of the gaseous substances. Generally too much air is admitted, which has the disadvantage of uselessly absorbing the heat. Mineral combustibles are much better

* It is unnecessary in this memoir to describe either the chamber in which this process takes place, or the requisite apparatus and details of the different processes.