

(No Model)

F. B. LAST & J. R. WRIGHT.
PROCESS OF MANUFACTURING STEEL.

No. 586,047.

Fig. 1. Patented July 6, 1897.

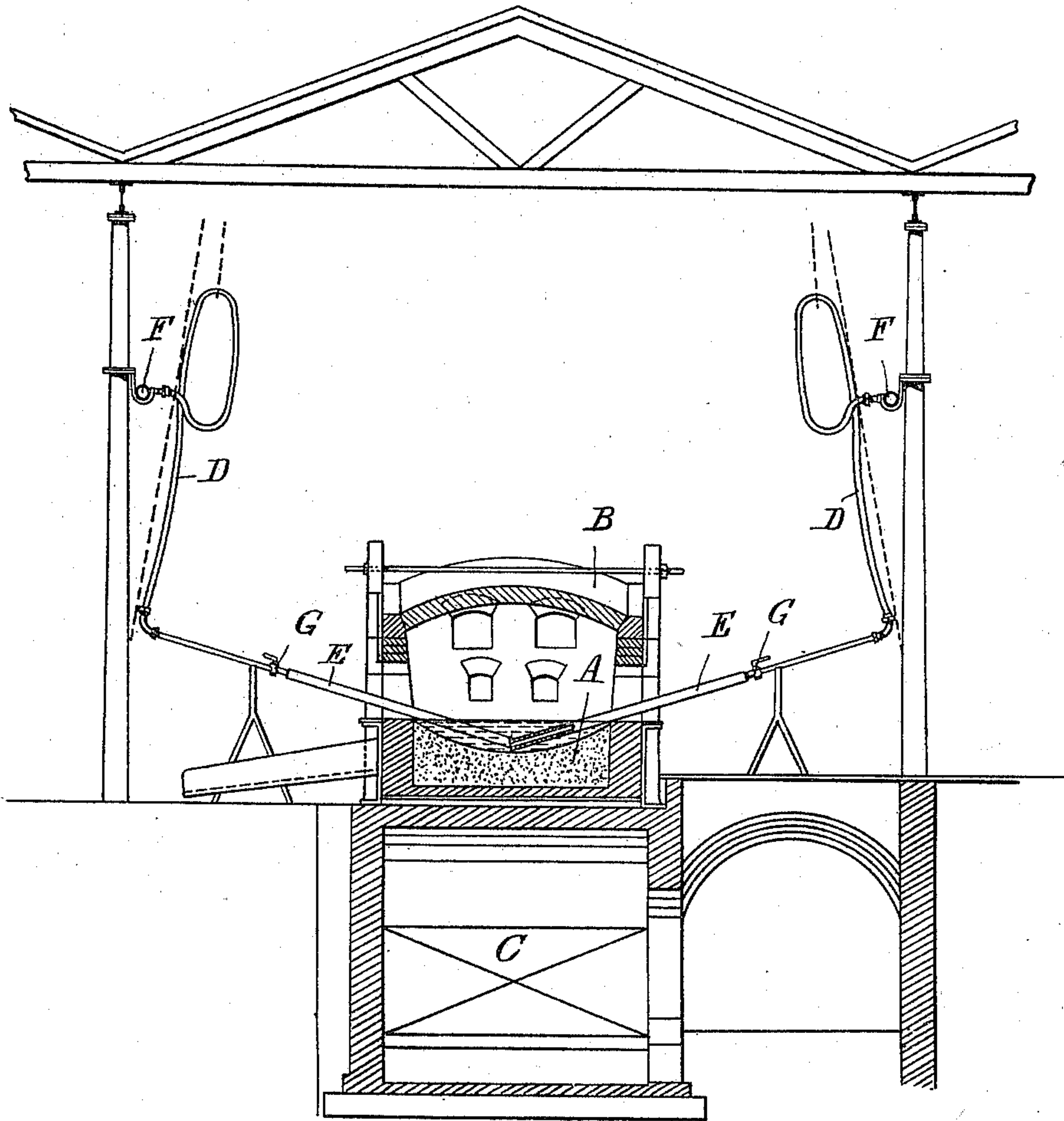
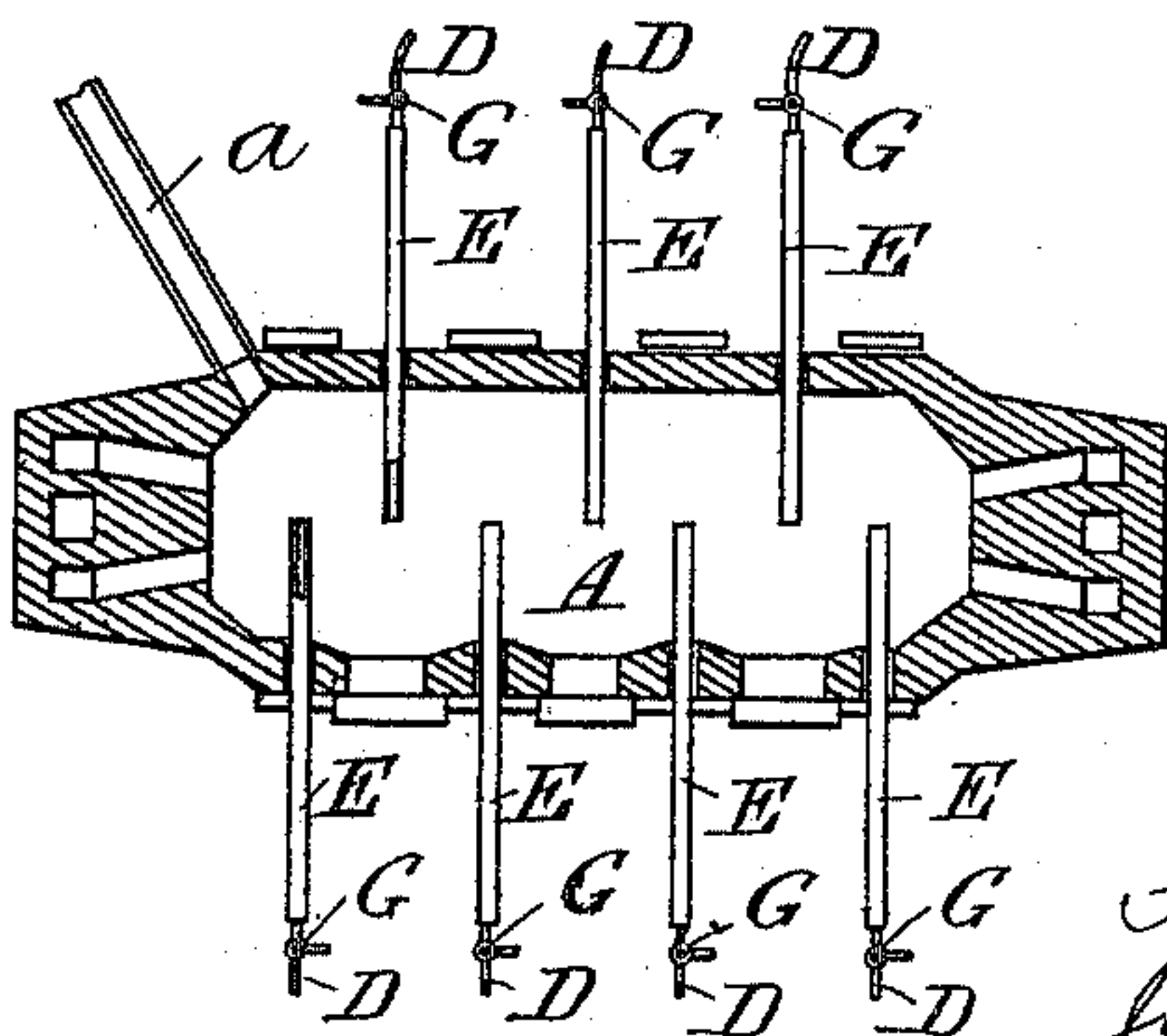


Fig. 2.



Witnesses:-

Geo. Lewis
J. T. Cameron

Inventors:-

Frank B. Last,
John R. Wright.
by Solloredo Mauro
their attorneys.

UNITED STATES PATENT OFFICE.

FRANK BERNARD LAST, OF LANDORE, AND JOHN R. WRIGHT, OF
GOWERTON, ENGLAND.

PROCESS OF MANUFACTURING STEEL.

SPECIFICATION forming part of Letters Patent No. 586,047, dated July 6, 1897.

Application filed April 27, 1896. Serial No. 589,112. (No specimens.)

To all whom it may concern:

Be it known that we, FRANK BERNARD LAST, manager to the Swansea Hematite Iron Company, Limited, residing at Landore, and JOHN ROPER WRIGHT, iron and steel manufacturer, residing at Elba Steel Works, Gowerton, near Swansea, England, subjects of the Queen of Great Britain and Ireland, have invented certain Improvements in the Manufacture of Iron and Steel, of which the following is a specification.

The object of our invention is to effect improvements in the manufacture of steel in the Siemens-Martin or Pernot or other open-hearth furnace; and we accomplish this by supplying air or steam or both to the molten mass through movable twyers, which can be moved about to different parts of the bath and thus disseminate the air or steam throughout the whole mass of molten metal.

To carry out our invention, we may either take molten iron from a blast-furnace, metal-mixer, cupola, or other like furnace, and introduce it directly into a Siemens-Martin, Pernot, or other open-hearth furnace, (whether acid or basic,) or in lieu of such molten metal we may melt pig-iron or may take a mixture of the two. A number of discharge-nozzles, twyers, or blast-jets, preferably with somewhat large outlet or outlets—say, for example, with an outlet of at least one inch cross-sectional area—are inserted into the charge near the bottom thereof and from opposite sides, but not so as to direct the blasts vertically downward onto or into the charge. These are movable by being swiveled near the apertures in the open hearth, so that they can rapidly be moved about to any part of the charge where air or steam or both may be required. They are moved about in the charge while the air or steam or both is or are forced into and up through the said charge at a suitable pressure, which must depend on the depth to which their outlets are immersed below the surface of the charge. When the temperature has increased sufficiently, iron ore can, if required, be introduced and the treatment be carried on as usual in open-hearth processes. The forcing in of air or steam or both in the manner aforesaid can be continued until the silicon and carbon are nearly

or wholly eliminated. Any convenient arrangement of the apparatus for conveying or injecting the steam can be adopted, provided that the requisite facility for moving the ejecting devices in the charge be provided and the air and steam be at sufficient pressure, and provided that the nozzles, twyers, or blast-jets are arranged so as to direct the air or steam or both at various points up through the whole charge and not vertically downward at one spot, which would not attain the object of our invention.

Preferably we attach to the injecting apparatus taps, whereby the supply of air or steam can be regulated. The pipes which form the ejection apparatus may be introduced by the doors or ordinary openings or by openings specially provided for the purpose on each side of the furnace and can be moved about in the charge. The connections between the pipes and the sources of air or steam under pressure may be conveniently made by flexible metallic tubing of a suitable kind.

Owing to the flexible connections the pipes constituting the twyers or blast-jets can be moved about in the molten charge and the air directed in such a way as to cause the whole of the molten charge to be thoroughly submitted to the action of the air or steam or both, a matter which is essential to success. The injection of air or steam or both can be stopped at any point according to the quality of steel required.

In order that our invention may be fully understood, we will now proceed to describe the same with reference to the annexed sheet of drawings.

Figure 1 represents in vertical section, and Fig. 2 in horizontal section, a Siemens-Martin furnace provided with an arrangement of blast-distributing jets according to this invention.

A is the hearth of the furnace, to which molten metal is conducted by the metal runner *a* direct from the blast-furnace or cupola or other furnace in which it has been reduced or melted.

B is the crown of the furnace, and C indicates the regenerative arrangements.

A suitable blast-main F and storage of air

or steam or air and steam under pressure and leading into the said main are provided, and from the said main are led flexible pipes D, which terminate in nozzle-pipes E, say of cast-iron, with an orifice of from one to two square inches cross-sectional area of outlet. These are protected by sleeves of refractory material, such as fire-clay. The said pipes may be provided with cocks G, by which the pressure of the air or steam or both can be regulated so as to give the proper degree of ebullition of the charge during the process.

As soon as the air or steam or both are admitted gas can be almost turned off, as sufficient heat is generated during the treatment, the gas being again turned on near the end of the operation and during finishing in the ordinary way. The air or steam or both air and steam should be turned on before the pipes are introduced into the charge.

We have shown in Fig. 2 seven single nozzles led in at the sides, but more or less can be used as desired, provided they are in sufficient number to bring the air or steam or both into contact with the whole charge and that they are directed into the charge so as not to direct the air or steam or both vertically downward at one part of the charge only. The said pipes are led into the charge from opposite sides, and those at one side alternate with those on the other, so as to give a very efficient action throughout the entire mass of the charge. It is essential that the said pipes be not directed downward vertically over or into the charge at one part thereof only.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. The manufacture of steel by introducing molten iron from a blast-furnace, cupola, or the like direct into a Siemens-Martin or Pernot or other open-hearth furnace operating in a neutral or reducing atmosphere and then forcing an oxygen-containing fluid into and up through the molten charge, the jets of fluid being introduced alternately from opposite sides and being moved about in the charge so as thoroughly to subject it to the action of the fluid, substantially as described.

2. The manufacture of steel by introducing molten iron from a blast-furnace, cupola, or the like direct into a Siemens-Martin or Pernot or other open-hearth furnace and then forcing an oxygen-containing fluid into and up through the molten charge as aforesaid the jets of fluid being introduced alternately from opposite sides and being moved about in the charge so as thoroughly to subject it to the action of the fluid substantially as hereinbefore described and adding ore and finishing the charge in the ordinary way.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

FRANK BERNARD LAST.
JOHN R. WRIGHT.

Witnesses:

GEO. HAMILTON,
THOS. JONES.