

C. J. EAMES.
 Manufacture of Iron and Steel.

No. 152,942.

Patented July 14, 1874.

Fig. 1.

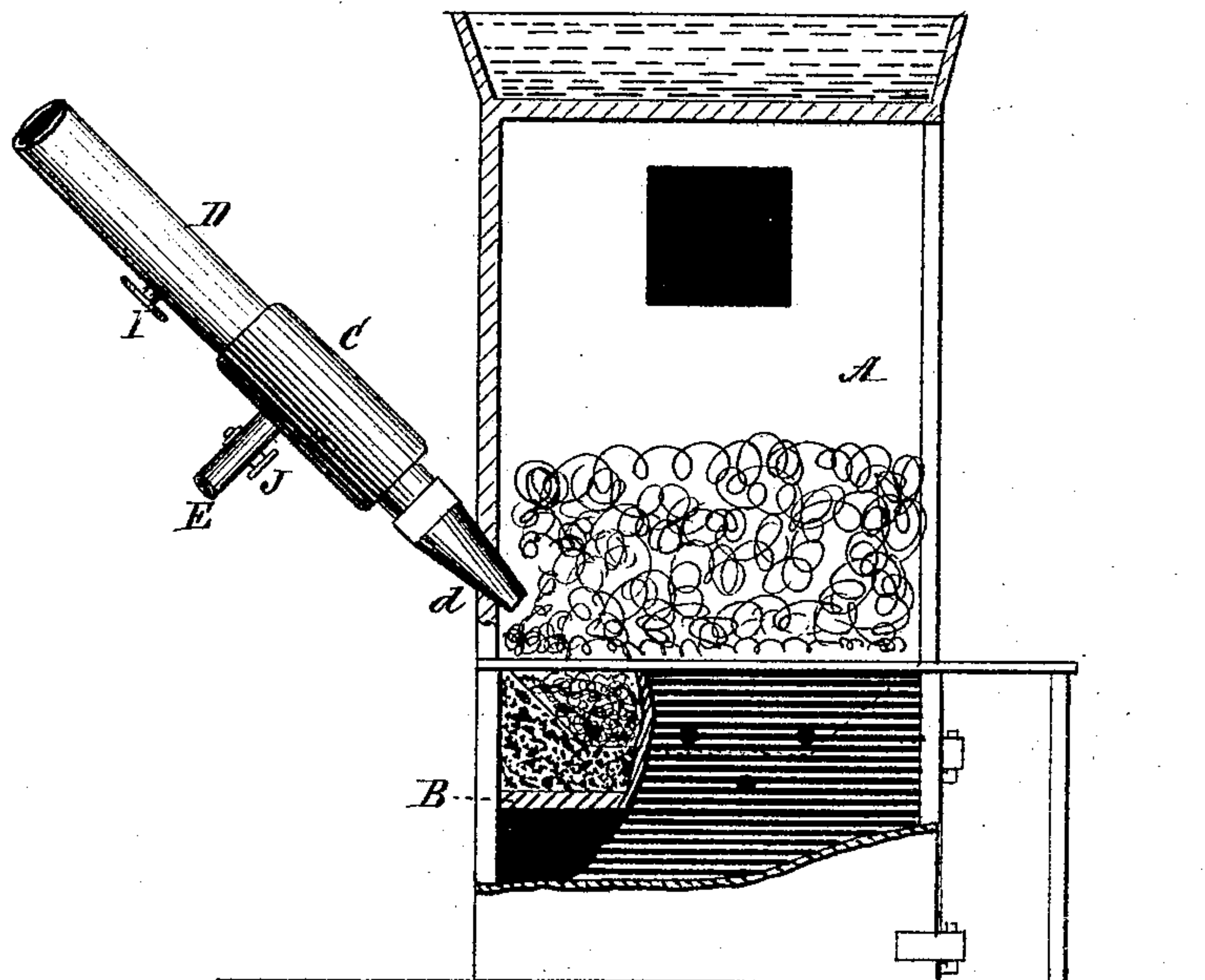


Fig. 2.

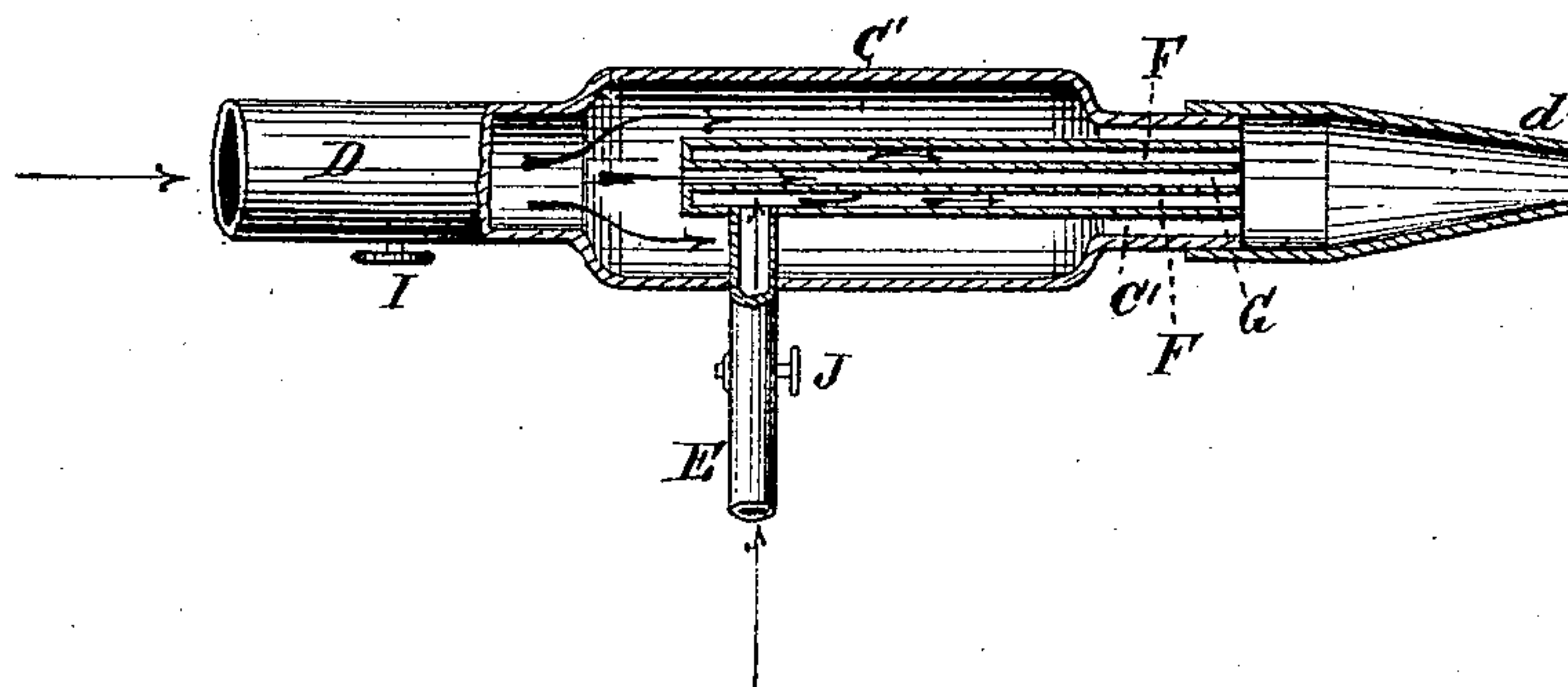
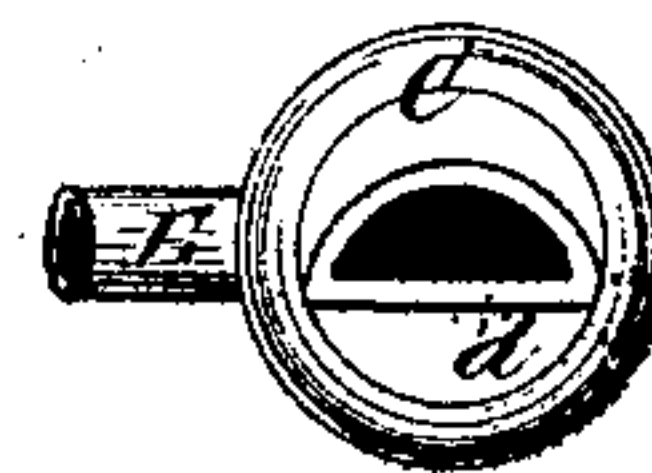


Fig. 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

CHARLES J. EAMES, OF NEW YORK, N. Y.

IMPROVEMENT IN THE MANUFACTURE OF IRON AND STEEL.

Specification forming part of Letters Patent No. **152,942**, dated July 14, 1874; application filed June 17, 1874.

To all whom it may concern :

Be it known that I, CHARLES J. EAMES, of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in the Manufacture of Iron and Steel; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The nature of my invention consists in constructing an ordinary open or sinking furnace for the production of charcoal-iron by substituting for the ordinary tuyere of such furnace a modification of my improved petroleum or other hydrocarbon-vapor burner, described in the patent granted March 3, 1874, and No. 148,042; and also in using this structure to carry out my new and useful process for producing a substitute for charcoal-iron by means of petroleum or other hydrocarbon vapor instead of charcoal; and also in a certain manner of preparing a bottom of quartz and sand, or charcoal-dust, as will more fully hereinafter appear.

To enable others skilled in the art to make and use my invention, I will now proceed to more fully describe its construction and operation.

In the drawings, Figure 1 is a vertical section of my invention, and Figs. 2 and 3 are enlarged detail views of the same.

A is the ordinary open or sinking furnace; D, the pipe supplying air from any suitable blower, and has a cock, I, with which to regulate the supply and power of the air-blast. C is my burner, which is shown in a somewhat different form in my patent above mentioned. This burner is formed of three tubes concentrically placed, so that between the outside one, C', and the one next to it, marked F, there is an annular chamber open at both ends, and a like, but smaller, chamber between this tube F and the inner and smallest tube G; but this chamber is closed at one end, and is connected with a pipe, E, at one side, and the smallest tube G is open at both ends. The inclosing tube C' is at one end—just at the ends of the

inner tubes nearest the furnace—made to taper for about six inches, or to the end projecting into the furnace, and changed from a cylindrical to a semi cylindrical form to resemble the blast end of the ordinary tuyere.

My burner C is connected with the air-supply pipe D, as very clearly illustrated in Fig. 1. The burner C is, by pipe D, supplied by a current of air that passes (when cock I is opened) between pipes C' and F, and through tube G, around the gas-chamber between tubes F and G, the current of air commingling with the gas that is supplied from pipe E, which communicates with a generator of petroleum or hydrocarbon vapor or gas—preferably the generator patented to me October 15, 1872, No. 132,266—this vapor or gas readily flowing from pipe E when cock J is turned into tube F, and thence into the tuyere-like end *d* of tube C', where it commingles and begins to burn, upon the principle and with the fierce and efficient heat of the Argand burner.

In the ordinary process of manufacturing charcoal-iron there is formed a bottom of lump-charcoal on the hearth B; then a layer of scrap-iron, or iron-ore combined with a flux, is laid over the bottom; then alternate layers of the metal, or ore and flux, until the furnace is filled. The blast of air is then turned on through the tuyere into the previously-ignited charcoal bottom; and from thence the heat passes upward, igniting successively each of the superposed layers of charcoal, causing the metal, or ore and flux, as the case may be, to sink or fuse toward the hearth. This mass as it settles down upon the hearth has added to it additional layers of the materials in alternate layers as when the mass was first arranged; and when the whole mass that has settled down on the hearth has formed a loop of suitable size and weight to be worked as a bloom the process is ended.

From the use of such an immense quantity of charcoal the iron made by this process is very expensive, and my process will substitute the less expensive petroleum vapor or gas for the charcoal, and thus reduce the cost of this metal. In order to carry out my process I have the apparatus constructed as above; and if I intend to use the charcoal-dust bottom I make it by packing the dust on the hearth B sev-

eral inches deep at the sides and corners, and hollowed out in the center in hemispherical shape, or somewhat shallower at the center of such hollow, the charcoal-dust to be about two inches deep—this hollow to receive the mass as it settles down from the effect of the heat; or if I intend to use the quartz and sand, enough is placed on the hearth B so that when this sand and quartz bottom has been fused, which is done previous to beginning to work the furnace, it shall be about two inches deep. The bottom having been prepared, the scrap-iron, or iron-ore and flux, as the case may be, is then piled up on the hearth B until the furnace is filled. The cocks I and J are then turned so as to permit a moderate blast to pass through the burner, and at this moment the vapor-blast is ignited when the charcoal-dust bottom is used. The ignited vapor-blast impinges upon the center of the hearth, and passes on up through the mass to be reduced to a loop. A moderate blast is continued until the whole mass has been homogeneously heated. When the mass has been heated by the moderate blast to the proper degree, the full blast is then turned on so as to supply sufficient vapor to rapidly reduce the mass without burning or wasting the metal. The mass is then added to with fresh materials until enough has been added to form a loop, which, when reduced to the proper form, is taken out and hammered into a bloom; or when I wish to convert the loop into steel, the whole mass, when it has been reduced to the size of a loop, is covered with charcoal-dust to a depth of about four or five inches. The air-cock I is partially closed, so as to diminish the supply of air, and cock J is turned on so as to furnish a copious supply of petroleum vapor to form a rich carbon flame; the loop then being carefully turned from time to time so as to receive the direct action of the flame on all its parts—always keeping it covered with charcoal-dust—until the process is completed, the time of its completion depending upon the size and weight of the loop and the quality of steel required.

It is sufficiently obvious that such a great increase in the amount of the charcoal-dust and richness of the hydrocarbon flame makes it possible for the iron loop to rapidly absorb and assimilate the necessary elements of carbon to convert the loop into steel. I find it advisable, in order to attain a high grade of steel, to combine during the formation of the loop with the mass of scrap-iron, or iron-ore and flux, various proportions of spiegeleisen and oxide of manganese. I have found a working proportion in about ten per cent. of spiegeleisen and four per cent. of the oxide of manganese to the mass of scrap-iron.

Any excessive accumulation of cinder, or oxide of iron, or other impurities, is drawn off in liquid state through the apertures provided for that purpose in the ordinary open furnace, from time to time, and only sufficient cinder is permitted to come in contact with the loop during its formation as is desirable. The cinder that falls from the bloom while being hammered may be put into the furnace, and economize any iron therein, and also aiding and furthering my process as in the old or ordinary process.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The process of producing a substitute for charcoal-iron by using petroleum or other hydrocarbon vapor in an open or sinking furnace, substantially in the manner herein described.

2. The combination of burner C, pipes D and E, with cocks I and J, furnace A B, and quartz and sand or charcoal-dust bottom, constructed and operating substantially in the manner and for the purposes specified.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

CHARLES J. EAMES.

Witnesses:

V. C. CLAYTON,
SOLON C. KEMON.