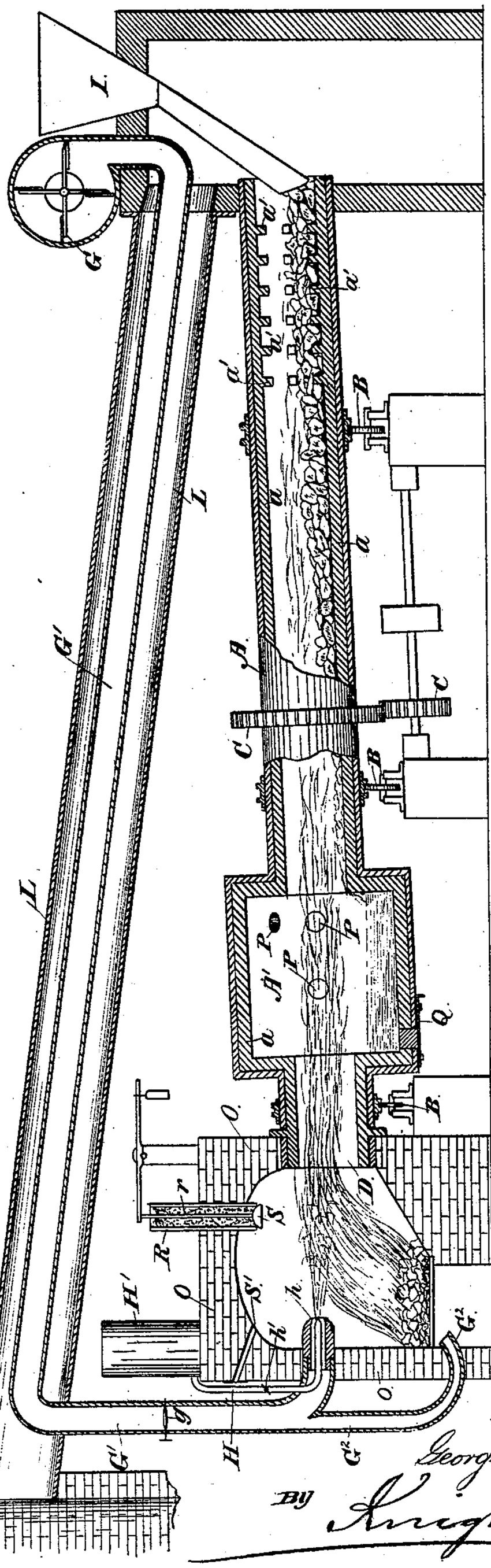
(No Model.)

G. DURYEE.

Blow Pipe Revolving Furnace.

No. 236,561. **Patented Jan. 11, 1881.**



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UNITED STATES PATENT OFFICE.

GEORGE DURYEE, OF RAHWAY, NEW JERSEY.

BLOW-PIPE REVOLVING FURNACE.

SPECIFICATION forming part of Letters Patent No. 236,561, dated January 11, 1881.

Application filed November 12, 1880. (No model.)

To all whom it may concern:

Be it known that I, GEORGE DURYEE, M. D., a citizen of the United States, residing at Rahway, in the county of Union and State of New Jersey, have invented a new and Improved Blow-Pipe Revolving Furnace for the manufacture of iron and steel and glass, of which the following is a specification.

My apparatus consists, essentially, of a suitable furnace for burning either solid, liquid, or gaseous fuel, a compound blow-pipe for injecting a combined jet of air and oil or gas across the flame of the fuel-furnace, and an inclined revolving cylinder, formed at its lower end with an enlarged chamber or annular basin provided with holes for manipulating and discharging the contents, said holes being closed by shutters when the cylinder is revolved. The materials to be treated are fed in through a hopper at the upper end of the cylinder. The air-blast pipe is preferably passed through an inclined stack, by which the products of combustion are carried off, so as to heat the air before its injection into the furnace. The revolving cylinder is made from thirty to sixty feet long, according to the desired capacity and the uses for which it is intended, and the effect of the combined blast of air and liquid or gaseous fuel impinging at the side of the furnace-flame in line with the center of the cylinder, or nearly so, is to drive an effective blow-pipe flame of very intense heat through the whole length of the cylinder.

In order that the invention and the mode of carrying it into effect may be fully understood, I will proceed to describe the same with reference to the accompanying drawing, which represents a longitudinal section of the apparatus.

O is a fuel-furnace, formed with a hearth or grate, having a blast underneath, and adapted for burning coal, wood, oil, gas, or any preferred fuel.

A is the revolving cylinder, made of any desirable length—say from thirty to sixty feet, according to circumstances—formed with an enlargement or annular basin, A′, at its lower end, and supported in slightly-inclined position by rollers B B, so that it may be freely rotated. The rotary motion is imparted by gearing C. The lower end of the cylinder is formed, as shown, with an annular flange, D, fitting within a recess prepared for it in the face of the furnace O, so as to receive all the products of combustion from the said furnace. The gases passing through the revolving cylinder A are carried off through an inclined stack, L.

I is a feeding-hopper, through which ores or whatever matters are to be treated are delivered into the upper end of the revolving cylinder A.

G is a fan for driving a blast of air through a pipe, G′, which is carried through the inclined stack L, for the purpose of heating the blast. The heated blast is delivered into the furnace O in a horizontal jet opposite the center of the revolving cylinder A, impinging against the side of the flame in the furnace, and driving a blow-pipe flame into and through the revolving cylinder, a jet of liquid or gaseous hydrocarbon being fed from a reservoir, H′, through a pipe, H, under control of a cock, *h′*, said pipe terminating within the furnace in a nozzle, *h*, concentrically within the delivery end of the air-blast pipe G′, the effect of this combined jet of air and hydrocarbon acting on the furnace-flame, as already described, to drive a blow-pipe flame of thirty to sixty feet in length, and of very intense heat, through the revolving cylinder A. An extension, G^2, of the air-pipe supplies a blast under the fuel in the furnace O.

R represents a hopper, controlled by a valve, S, and rod *r*, for containing powdered charcoal and common salt, to supply carbon and chlorine to the blast as it enters the mouth of the revolving cylinder.

The lining *a* of the cylinder A may be of fire-brick, but is preferably made of a mixture of plumbago, asbestus with molasses, or other material, to form a temporary bond. This material is tamped in around a wooden core and burned, the heat destroying the core and vitrifying the lining into a strong and continuous body. Projecting shelves are formed in the lining at the upper end of the cylinder, as at *a′ a′*, to carry up the material and drop it through the flame and gases as the cylinder revolves. The inclination of the cylinder A may be about half an inch to the foot.

P P are openings covered by shutters Q, and

employed for manipulating the metal, drawing off slag, and discharging the finished metal. S′ S′ are peep-holes covered with mica, for inspecting the work.

Manner of working: Ores of iron, as well as the lime or other flux, should be crushed to size of walnuts, although by using a sixty-foot furnace this is not essential. About a ton of hematite iron ore and a quarter of a ton of lime and half a ton of anthracite or bituminous coal dust or slack, or five hundred pounds of charcoal are fed in the ore-hopper at upper end of cylinder. As they pass down they are carried up by the shelving or projecting fire-brick in the upper twenty-five feet of the cylinder, dropping through the carbonic-oxide gas generated from the blast and the coal-dust, and in the upper half of a sixty-foot furnace will be found deoxidized or reduced, prepared for the second or melting process, to be done in the lower half of the cylinder. When the ores are deoxidized the metallic iron fusing runs into the enlarged annular basin at lower end of furnace and settles to bottom under the slag. When the basin is nearly full of melted slag and metal one of the doors or tap-holes should be opened and the cylinder turned down, so as to drain off all, or nearly all, the slag. The door is then closed and the metal is subjected to a few moments' revolution of the furnace, and if there is phosphorus in the ores chloride of sodium should be then fed in the carbon-feeder, chlorine being evolved copiously and the heat increased, as chlorine at the temperature of about 3500°, I find, eliminates all the phosphorus in the ores. The cylinder is then stopped and the metal allowed to settle a few moments, when the tap-hole is again opened and the pig-iron run into sand molds.

If it is desired to convert the iron into steel or wrought-iron, the metal should be exposed about fifteen minutes to the oxidizing blast of the blow-pipe, produced by closing the oil-pipe and allowing no carbon to mingle with it. In a few moments the metal begins to assume a pasty condition, and by the continued revolving of the cylinder the carbon is nearly all driven out, when wrought-iron billets or blooms will be formed mechanically. The blow-pipe blast will obviate the use of ferro-manganese to a certain extent, as the pure oxygen-blast will be found to drive off the sulphur and carbon, thus forming steel. When the blooms are in condition to be removed, which will be seen by opening a door and testing them with a rod, they are to be dumped out, preferably direct into squeezers fitted up under the cylinder, so as to squeeze out the adhering scoria. Peep-holes in the walls of the fuel-furnace allow the furnace-man to observe the condition of the metal.

In ores containing a large percentage of oxygen it is essential to feed a surplus of oil with the blow-pipe blast or powdered charcoal in carbon-hopper R.

The air-blast pipe has a damper, g', to control amount of air to be fed.

Some ores and iron may require manganese to the amount of, say, one per cent., which may be supplied in powder through hopper R, or the amount of speigeleisen to be added in the door as a last operation of producing steel.

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

1. The combination of the revolving cylinder A, having an annular basin or enlargement, A′, and working-holes P, the fuel-furnace O, air-blast pipe G′, and hydrocarbon-nozzle *h*, as and for the purposes set forth.

2. The combination of the revolving cylinder A, fuel-furnace O, inclined stack L, and compound air and hydrocarbon blow-pipe G′ H, as and for the purpose set forth.

3. The process of dephosphorizing iron and iron ore by feeding the material continuously through an inclined revolving cylinder in contact with a blow-pipe flame produced by a combined blast of air and hydrocarbon striking against the side of the flame of an adjacent fuel-furnace and supplied with chlorine, as described.

GEORGE DURYEE.

Witnesses:
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