(Specimens.)

G. W. GESNER.

PROCESS OF AND APPARATUS FOR ALLOYING IRON AND HYDROGEN.

No. 604,580. Patented May 24, 1898.

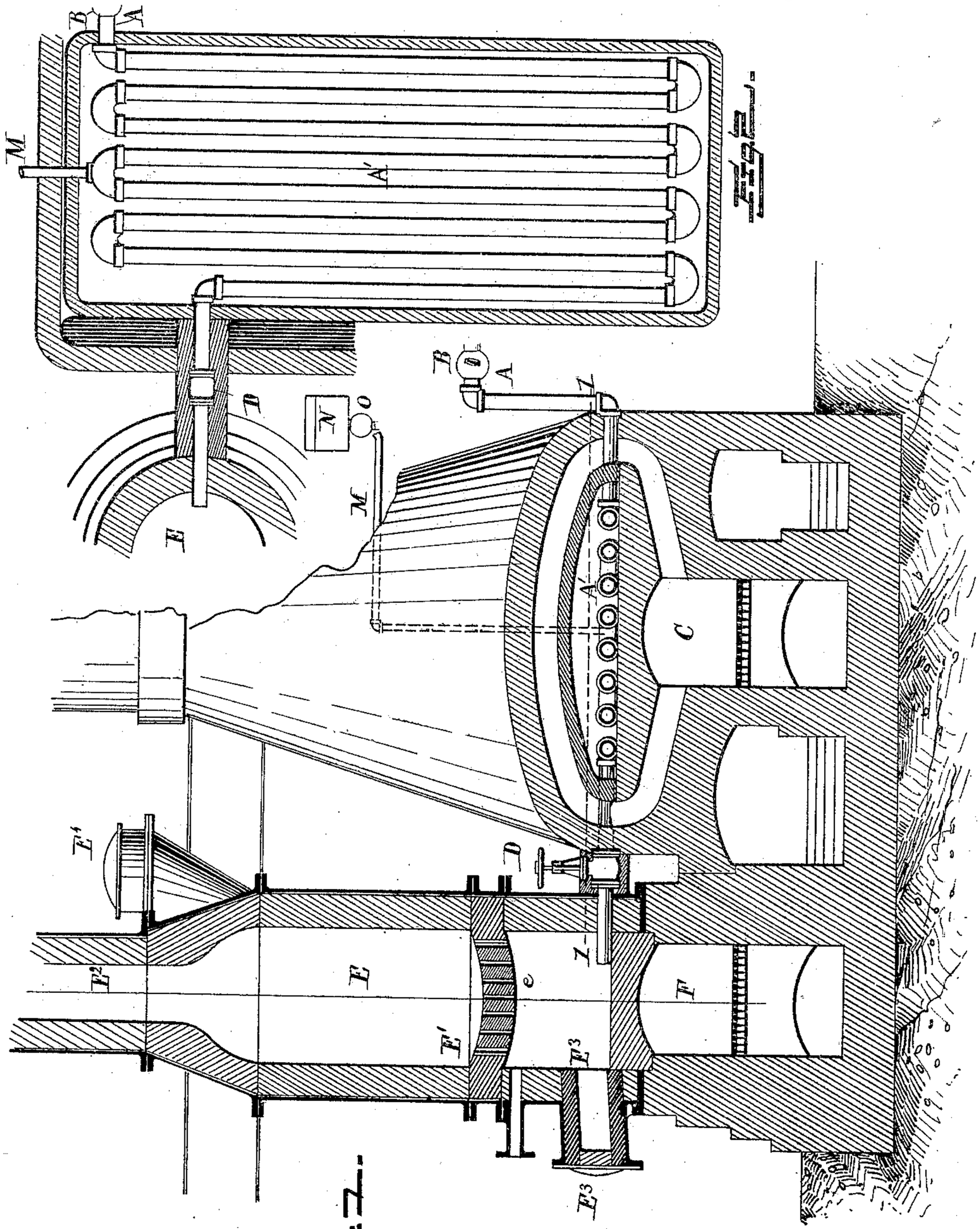

Fig. 7.

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PROCESS OF AND APPARATUS FOR ALLOYING IRON AND HYDROGEN.

SPECIFICATION forming part of Letters Patent No. 604,580, dated May 24, 1898.

Application filed December 10, 1895. Renewed November 4, 1897. Serial No. 657,426. (Specimens.)

To all whom it may concern:

Be it known that I, GEORGE WELTDEN GESNER, a citizen of the United States, residing in the city of New York, in the county and State of New York, have invented a certain new and useful Improvement in Metallurgy, of which the following is a specification.

I produce a new alloy composed of iron and hydrogen in condition to be worked either by forging or by casting. The apparatus by which it may be produced is somewhat similar in operation to the familiar means of producing steel credited to Henry Bessemer in so far as the melting of the iron and blowing a gas up through it is concerned. I, however, thus blow up hydrogen alternately with vapor of naphtha.

The alloy possesses extraordinary properties in resisting oxidation and corrosion. It is unaffected even by sulfuric acid or aqua regia. It can be worked by tools in the same manner as iron. Its specific gravity is somewhat less; but it possesses nearly the strength of iron.

My experiments indicate that the union of the hydrogen with the iron is stable and will remain under all ordinary or extraordinary conditions to which it may be subjected.

The accompanying drawings form a part of this specification and represent what I consider the best means of carrying out the invention.

Figure 1 is a vertical section on the line 1 1 in Fig. 2. Fig. 2 is a horizontal section of a portion of the apparatus in Fig. 1.

Similar letters of reference indicate corresponding parts in both the figures.

A is a pipe bringing steam from a boiler (not represented) at a sufficiently high pressure to enable it to rise through melted iron of the required depth.

A′ is a series of convolutions in such pipe, heated by a fire in the furnace C below to a temperature about 1,500° Fahrenheit. I will for brevity term this a "coil."

B is a valve which controls the flow of the steam from the boiler to the coil, and D is a second valve which controls the delivery of the contents of the pipe into the base of the converter. The effect of the apparatus, so far as yet described, is to decompose the steam, the oxygen going to line the interior of the coil A′ with oxid of iron, while the hydrogen thus liberated moves forward. When the operation is properly conducted, free hydrogen alone in the first part of the treatment and the same with hydrocarbon vapor at a later stage is delivered past the valve D into the base of the converter.

E is a converter represented as stationary; but it may be arranged to tilt on trunnions like the ordinary Bessemer converter, if preferred in any case. The converter being properly heated in advance by ordinary means and the fire in the furnace F below being kept up, the hydrogen is allowed to flow past the valve D and to rise through the apertures *e* in the false floor or bottom E′ and escape through the stack E^2. Now No. 1 iron, or, preferably, scrap iron or steel, in a fluid condition, at a very high temperature, as far above the ordinary melting-point as is conveniently attainable, is introduced through the charging-nozzle E^4, and the hydrogen is blown up through the melted mass lying on the false bottom.

It will be understood that the apparatus presents a thick coating of fire-brick or other refractory non-conducting material to maintain the heat and a lining of ganister or other suitable material to maintain the integrity of the interior. The conditions may in all points not otherwise described be as in treating iron with air under corresponding high pressure in the Bessemer process for the manufacture of steel.

A hydrocarbon-inlet pipe M leads from a vessel, which for convenience may be the small vessel N, at an elevation of about twenty-five feet above the coil A′. In this for each batch of one ton of melted iron I place one (1) quart of naphtha, about 65° to 70° Baumé, and tightly close the vessel N, the descent of the naphtha being controlled by a cock O.

The pressure of steam in the coil A′ in the converter-bottom and beyond is controlled by the valve B. Such pressure is maintained at about forty pounds, except for a short period.

After the operation is continued about two (2) hours this valve B is so far closed that the pressure in the coils is lowered to about ten (10) pounds per square inch and the cock O is opened, allowing the naphtha to descend through the pipe M and enter the coil A′. This condition is maintained for about twenty (20) minutes, when the naphtha will be found to have nearly or quite all descended. Now the cock O is closed and the valve B is again set wide open, restoring the full steam-pressure in the apparatus, and this condition is maintained for forty (40) minutes or until the end of the operation. The entire treatment will occupy about three (3) hours under ordinary conditions. The melted iron absorbs the hydrogen and forms my alloy. As nearly as I have been able to determine, aided by a great number of small experiments, the temperature should be about 2,800° Fahrenheit and the depth of the melted iron should be about fifteen (15) inches. When the iron ceases to absorb the hydrogen, the fact is indicated by a yellow color in the flame escaping from the stack E^2. When this stage is reached, the hydrogen may be shut off by closing the valve D and the melted metal allowed to descend through the passages *e* into the lower part of the converter, and the tap E^4 being opened it is drawn out and may be cast into pigs or into any desired useful or merchantable forms. It may be subsequently melted and recast, like cast-iron.

My alloy may be changed by puddling in the same manner as ordinary iron, and it may be afterward forged and rolled in the same manner as ordinary wrought-iron.

I ascribe to the treatment with naphtha at one stage in the process an important duty in absorbing and carrying away any oxygen which may by any chance be present in the alloy.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention.

It will be understood that the treatment of the steam in the convolutions E′ of the pipe E is the mode which I consider most desirable for producing hydrogen from steam in the liberal quantities and at the pressures required. The interior of the coil A′ may be subsequently deoxidized by flowing a hydrocarbon through the same at a proper temperature, as has long been practiced by myself and others. The hydrogen for my treatment may be produced by other means than the decomposition of steam.

I can treat ores of iron and produce my alloy at the same time that the iron is first reduced from the ore to the metallic state. To effect this, I use a converter or equivalent non-conducting vessel with provisions for admitting a gaseous blast and for discharging the finished product, charging the converter with fuel, iron ores, and flux in the proportions indicated by the chemical composition of each.

The purest iron and steel and the richest and most easily-reducible iron ores require less hydrogen for alloying than the poorer qualities of either. Approximately sixteen thousand (16,000) cubic feet of hydrogen at the temperature of 60° Fahrenheit and barometer 30° or a quantity of that element equal to the conversion of six thousand (6,000) pounds of water into steam before it enters the coil A′ is sufficient for the alloying of two thousand (2,000) pounds of iron or steel and of the metallic yield of the ores of iron in proportion to their composition.

I will use the word "iron" in the claims to include steel.

Carbon and very likely many other elements usually associated with iron may be present also in my alloy, producing their ordinary effects without seriously injuring the properties of the alloy.

I do not herein claim the subject-matter of this application except as referred to in the succeeding claims, but I reserve the right to cover the same in a distinct pending application filed by me March 10, 1896, Serial No. 582,600.

I claim as my invention—

1. The process described of manufacturing an alloy of iron and hydrogen, the same consisting in first passing jets of hydrogen through a mass of melted metal and thereafter similarly circulating hydrogen and hydrocarbon vapor combined, substantially as herein specified.

2. The process described of manufacturing an alloy of iron and hydrogen, the same consisting in first passing jets of hydrogen through a mass of melted metal, subsequently similarly circulating hydrogen and hydrocarbon vapor combined, and thereafter resuming the introduction of hydrogen alone until the flame at the top of the mass indicates a yellowish hue, substantially as herein specified.

3. In apparatus for the production of an alloy of iron and hydrogen, the combination with a furnace inclosing an iron coil communicating with a source of steam-supply and capable of decomposing the steam to form hydrogen under pressure, of a converter having a chamber for a mass of melted metal provided with a perforated bed, and a communication between the coil and converter below the bed of the latter, the connections at both sides of said coil having suitable controlling-valves, substantially as herein specified.

4. In apparatus for the production of an alloy of iron and hydrogen, the combination with a furnace inclosing an iron coil communicating with a source of steam-supply and capable of decomposing the steam to form hydrogen under pressure, of a converter having a chamber for a mass of melted metal, provided with a perforated bed, a communication between the coil and converter below the

bed of the latter, and a hydrocarbon-supply connecting with the coil, the several connections of the coil with the steam and hydrocarbon supply and with the converter having suitable controlling-valves, substantially as specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

GEORGE W. GESNER.

Witnesses:
J. B. CLAUTICE,
M. F. BOYLE.