

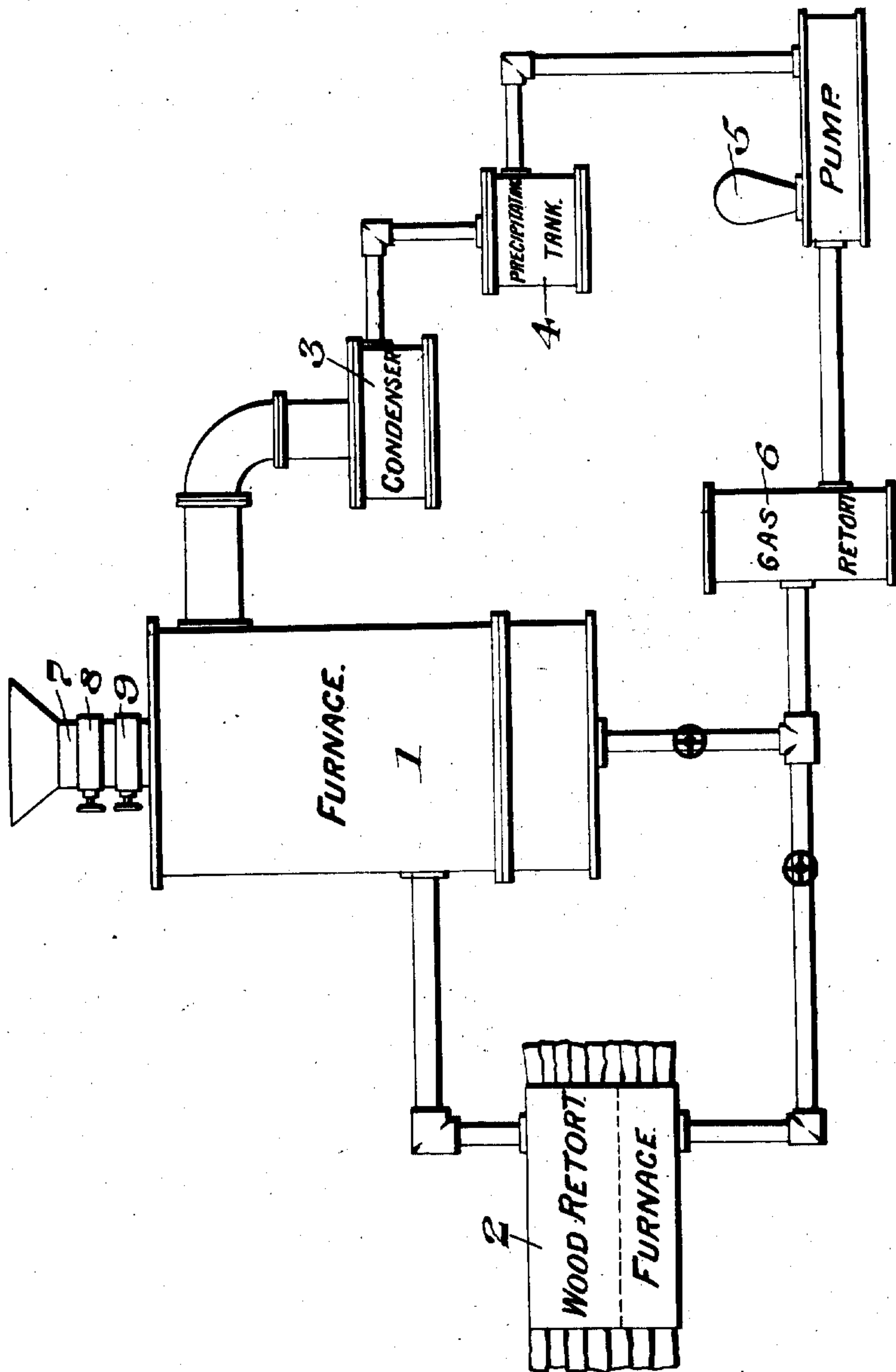
G. F. RENDALL.

PROCESS OF REDUCING METALLIC SUBSTANCES BY VOLATILIZATION AND PRECIPITATION.

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903,317.

Patented Nov. 10, 1908.



Witnesses

P. B. Nagle.
M. G. Lusk.

Inventor

George F. Rendall.

By

Wiedersheim & Leibauer.

Attorneys

UNITED STATES PATENT OFFICE.

GEORGE FREDERICK RENDALL, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN REDUCTION COMPANY, A CORPORATION OF NEW JERSEY.

PROCESS OF REDUCING METALLIC SUBSTANCES BY VOLATILIZATION AND PRECIPITATION.

No. 903,317.

Specification of Letters Patent.

Patented Nov. 10, 1908.

Application filed July 24, 1905. Serial No. 271,041.

To all whom it may concern:

Be it known that I, GEORGE FREDERICK RENDALL, a citizen of the United States, residing in the city and county of New York, State of New York, have invented a new and useful Process for Reducing Metallic Substances by Volatilization and Precipitation, of which the following is a specification.

My process relates to the treatment of metallic substances such as zinc, arsenic, sulfur, antimony and more particularly to minerals which readily volatilize and consists in a process for the reduction of mineral substances by volatilization and subsequent precipitation.

In the accompanying drawing I have shown a diagrammatical view of a form of apparatus which may be employed in carrying out my process in which 1, designates the furnace in which the metallic substance is placed, which is in suitable connection with a wood retort 2 in which the hydrogenous gases are formed or produced.

3 designates the condenser which is in suitable connection with the furnace 1 and which is adapted to receive the fumes from the furnace, said condenser being also in suitable communication with the precipitating tank in which the lighter particles of the fumes are precipitated.

5 designates a pump which is in suitable connection with the precipitating tank 4 and with the gas retort 6, the latter being in suitable connection also with each of the furnace 1 and the wood retort 2.

7 designates the feed pipe for the furnace 1 which is provided with the upper and lower valves or gates 8 and 9, in order that by the proper manipulation of the said valves, the material may be fed to the furnace without the admission of air.

The ore or material to be reduced is placed in the furnace in a closed chamber, suitably connected with a second closed chamber by means of valved pipes, there being also a plurality of gas producing retorts adapted to maintain a uniform supply of gas.

In the operation there is always an excess of hydrogenous gases maintained in the various chambers through which the metallic fumes pass, so as to prevent the formation of any oxid. As the entrance of any external air to the chambers is prevented, all danger from explosion which might arise if an excess

of oxygen should be admitted is eliminated. These retorts or chambers are adapted to be heated by any suitable means, the flame passing under and around said retorts and escaping through a chimney.

When the apparatus is operating, the fumes from the ores which have been placed in the closed chamber and which are separated by the heating operation are carried by the gases generated into the second chamber and thence into the condenser by means of a suitable valved pipe.

The condensing chamber is fitted with an internal water cooler, the latter having attached thereto a plurality of pipes through which a circulation of cooled water is maintained. The gases on entering this condenser are quickly reduced in this cooling chamber and the metallic particles precipitated into a bowl which is rigidly attached to the under side of the condenser. After this condensation, heat is applied to the metallic particles in the bowl, and they are then drawn-off as molten metal through a tap-hole in said bowl. The lighter particles, consisting of sulfureted hydrogen and hydrogenous products, ascend in the condenser and pass off through escape pipes which are provided with suitable valves. These pipes lead into precipitating tanks or vessels in which is contained a suitable supply of acid, said tanks being suitably lined with any acid resisting material. The sulfur is precipitated in this tank, as flower of sulfur, by means of acids and chlorids, sodium chlorid being preferably employed. The hydrogen, freed from impurities, is drawn off by means of suction pumps through suitably valved pipes and passes thence into a gas holder from which lead pipes also provided with suitable valves and which extend under the different retorts where they are connected to suitable burners, thus furnishing a source of heat for the combustion.

The hopper or ore bin is connected by suitable pipes to the retort in which the material to be reduced is placed, said pipe being provided with a plurality of valves. When it is desired to charge said retort, the upper valve is opened, the material inserted, the upper valve then closed and the lower valve opened, thus permitting the material to pass into the retort, and thus enabling the ores to be admitted without in any appreciable way, alter-

ing the gases therein or permitting their escape therefrom. This retort chamber is provided with a rake or rabble whereby the ore to be reduced may be spread in the retort
5 without opening the same to the atmosphere. In the wood retort for producing the gas, any material containing hydrogen and which volatilizes readily under heat, such as wood, for example, may be employed. When said re-
10 tort is heated, the containing hydrogen escapes from the material and passes over into the retort in which the ore to be reduced is retained, passing through the metallic fumes as they rise from the mineral substances.
15 The formation of any oxid is thus prevented.

After the wood has been treated for a sufficient length of time, usually from four to five hours, the gas producing retort is opened and the wood extracted therefrom through a
20 suitable door provided in said retort, and this when cooled, forms an excellent charcoal. This charcoal must be cooled in a closed chamber or under cover in order to prevent its combustion. The retort in
25 which the material to be reduced is placed is only opened at intervals, such as when it is necessary to remove the slag from the furnace hearth. Each retort is provided with tight fitting doors luted in operation with
30 any suitable material. The sulfur contained in the ore first forms a hydrogen compound and is then precipitated as a solid in the acid tanks and subsequently extracted by any convenient method. It will be observed
35 that in this process as above described, I effect a great economy when wood is employed to form the gas. All the metallic contents of the ore are saved, being volatilized, carried over and precipitated in the
40 condenser or remaining in metal globules in the slag.

The sulfur is precipitated, as before explained, in the acid chamber as a pure article of commerce. The gases generated are used

for the heating of the different retorts, the 45 charcoal which has been produced from the wood, remaining in the wood retort. If a supply of wood cannot be obtained the hydrogen gas is produced by the decomposition of steam passing through a mass of incandes- 50 cent carbon.

It is evident that many different kinds of material may be employed for generating the gas for reducing the metallic substances.

It will be evident that various changes 55 may be made by those skilled in the art, which may come within the scope of my invention and I do not therefore desire to be limited in every instance to the order of the steps taken as herein described. 60

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

1. The process for reducing minerals, which consists in reducing the volatile parti- 65 cles of the ore in a closed chamber, concurrently therewith subjecting the ore and fume to a current of wood gas and subsequently precipitating the metallic contents of the fume. 70

2. The process of reducing minerals, which consists in, volatilizing the component parts of the ore in a closed chamber, concurrently therewith subjecting the fume to a current of wood gas, and subsequently pre- 75 cipitating the metallic content of the fume.

3. The process of reducing ores, which consists in volatilizing the component parts thereof, concurrently therewith subjecting the fume to a current of wood gases, subse- 80 quently precipitating the metallic portion of the volatilized gases, and then separating the lighter particles from said gases.

GEORGE FREDERICK RENDALL.

Witnesses:

M. G. LUKENS,
H. S. FAIRBANKS.