(No Model.)

# J. REESE.

## PREPARING, INDURATING, AND SOLIDIFYING CALCAREOUS LINING MATERIALS FOR FURNACES.

No. 249,548. Patented Nov. 15, 1881.

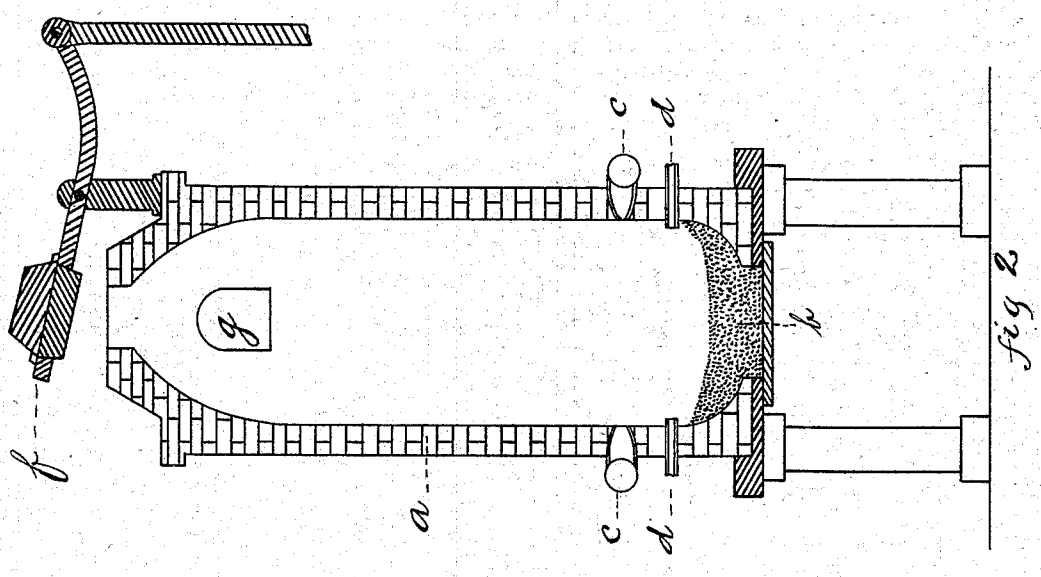



Fig 2

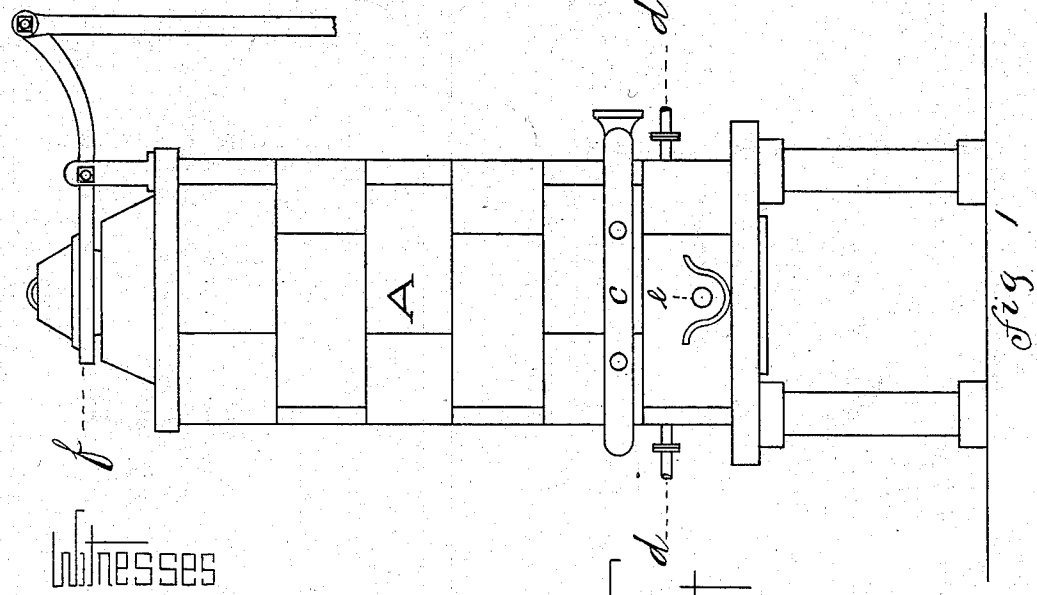



Fig 1

Witnesses
Walter Reese.
Geo. C. Reese.

Inventor
Jacob Reese

N. PETERS. Photo-Lithographer, Washington, D. C.

# UNITED STATES PATENT OFFICE.

JACOB REESE, OF PITTSBURG, PENNSYLVANIA.

## PREPARING, INDURATING, AND SOLIDIFYING CALCAREOUS LINING MATERIALS FOR FURNACES.

SPECIFICATION forming part of Letters Patent No. 249,548, dated November 15, 1881.

Application filed June 15, 1881. (No model.)

*To all whom it may concern:*

Be it known that I, JACOB REESE, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Preparing, Indurating, and Solidifying Calcareous Lining Materials for Furnaces; and I hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 indicates a front elevation of an improved apparatus adapted to the use of my improvement. Fig. 2 indicates a central sectional elevation of the same.

Like letters of reference indicate like parts wherever they occur.

My invention consists in a new and useful process for fusing, indurating, and solidifying calcareous or calcareous magnesian materials preparatory to their use as linings for Bessemer and other metallurgical vessels or refining-chambers.

The object of the invention is to fuse refractory basic lining materials and indurate, harden, and solidify them in a cheap and economical manner.

Heretofore limestone, magnesian limestone, and dolomite have been generally regarded as practically infusible, and such is stated to be a fact in almost all works upon chemistry and metallurgy. In experimenting upon this subject, however, I have found that these statements must have had reference to the purer qualities of materials when subjected to the heat of ordinary furnaces and when the materials were separated from the fuel employed in order to prevent its fluxing action upon them.

It is a well-known fact that silica, alumina, and oxide of iron exert a highly fluxing action upon lime, and an analysis in "Rogers's Metallurgy" of eighty-nine samples of limestone and dolomite shows that the average amount of fluxing materials contained in the samples is equal to about twenty-five per cent. (25%) of the combined weight of the lime and magnesia contained in them, and it is evident that limestone containing such an average amount of fluxing elements may be fused without any serious difficulty. The chief grounds, therefore, upon which statements of the infusible character of limestone and dolomite must rest is, I believe, on the purity of the materials operated upon, their exclusion from the fuel, and the imperfect apparatus and manner in which such experiments were conducted, for the fact has been developed by my experiments that ordinary limestone or dolomite can be fused if charged with twenty-five per cent. of its weight with coke into a cupola which has been previously raised to a high temperature and then subjected to a strong blast, for which method of fusing these materials I have recently made an application for a patent. My present invention, however, is based on a somewhat different ground—namely, the discovery that carbon has the same effect upon limestone, magnesia, dolomite, and magnesian limestone as it has upon iron. It is well known that the fusion-point of iron is reduced in proportion to the amount of carbon contained in the metal. It is also well known that carbonaceous ores are more fusible than those which contain no carbon. Now, in heating limestone in the ordinary way the carbonic acid contained in it escapes before the material can attain its point of fusion, and lime, an almost infusible substance, is produced.

To secure the advantage of carbon as a fusing agent I heat the limestone under a sufficient pressure to prevent the elimination of its carbonic acid until it is fused. The material is then run into suitable molds or shapes to form the lining, or the limestone may be fused by heating it in a cupola with coke and by forcing a stream of hydrocarbon or other carbonaceous vapor into the cupola and through the calcareous material in such quantities as to produce an excess of carbon passing through the calcareous material, and by this means I keep the material saturated with carbon until fusion takes place.

Burnt lime may be fused also by mixing it with carbon or with tar, petroleum, asphaltum, or other carbonaceous matters until it forms a stiff mass. The mixture is then charged with coke into the furnace or cupola, which has been previously properly heated with coke and the air-blast, and is subjected to a high heat until fusion takes place.

In the use of my improvement I first construct a cupola as shown in the drawings. A indicates the shell of the cupola, which is lined with limestone blocks and with a bottom of

burnt lime mixed with petroleum or asphaltum in the manner set forth in Letters Patent No. 219,519, granted to me on the 9th day of September, 1879. *a* indicates the limestone lining. *b* indicates the bottom. *c* indicates the blast-pipe and blast-tuyeres. *d* indicates supplemental tuyeres located between the blast-tuyeres and the bottom. These supplemental tuyeres are used for injecting carbonaceous vapors or fluids into the cupola as desired during the operations. *e* indicates the tapping-hole, and *f* indicates a weighted valve, which closes the top of the cupola in order to retain a sufficient pressure therein to prevent the escape of the carbonic acid from the materials under treatment until their fusion takes place. *g* indicates a charging-door near the top of the cupola.

The operation is as follows: I first charge the cupola with coke until it is filled up for about five or six feet, and then blow it with a brisk blast until it is thoroughly heated. I then charge the limestone, admixed with about one-fourth of coke, through the door *g*. The door is then closed and fastened, and the valve at the top of the cupola is adjusted to retain about five pounds (more or less) pressure to the square inch in the cupola. The blast is then blown briskly until the limestone has become fused, when the pressure is relieved and the calcareous material is tapped into a suitable mold or molds and the lining formed, or it may be cast into forms for tuyeres or brick, as may be desired.

A modification of the above may be practiced as follows: The cupola may be charged with coke, fired, and blown until highly heated. Limestone may then be charged with about one-fourth its weight of coke. The door is closed and the blast let on. In addition to the coke I force into the cupola with the air (or preferably below it) through pipes *d d* a stream of hydrocarbon or a carbonaceous vapor in such quantity as to secure the saturation of the lime or calcareous material with carbon. This may be readily determined by the exit of the gas out of the contracted throat of the cupola. When the carbon is in excess the gas will burn with a vivid flame after its escape into the air, and if the carbon is not in sufficient quantity to saturate the calcareous material the gas will not burn on its escape. When the proper temperature is secured in the presence of sufficient carbon in a vaporized condition to saturate the lime fusion takes place, and the calcareous material may be tapped out and molded into any desirable form. The opening at the top of the cupola should be so contracted as to keep a constant pressure in the cupola of not less than half a pound to the square inch below the pressure of the blast, (whatever that may be,) in order to prevent the rapid escape of the carbonaceous vapor which is used to saturate the calcareous material.

Instead of using the carbonaceous vapor or hydrocarbon-vapor in the base of the cupola, the limestone or lime may be mixed with tar, petroleum, or asphaltum, or other vehicle of carbon previous to charging the material into the cupola; but in this case the carbon is more liable to escape than when it is forced in through the tuyeres during the entire operation.

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

1. The method herein described for preparing calcareous or magnesian materials for linings, which consists in charging the materials with coke into a suitable cupola, and then heating the materials under a sufficient pressure to retain an excess of carbon in the gases of the cupola and to prevent the escape of the carbonic acid from the material until fusion takes place, and, finally, running the material into suitable linings or shapes.

2. The method herein described for preparing calcareous or magnesian materials for linings, which consists in charging the materials into a cupola, heating the same, and injecting sufficient carbonaceous vapor into the cupola to prevent the escape of the carbonic acid from the material until fusion takes place, and, finally, running the melted material into suitable shapes for linings.

3. The method herein described for the preparation of materials for calcareous linings, which consists in first mixing lime with carbon or a hydrocarbon, and then subjecting it to a high temperature in a cupola until fusion takes place, and, finally, running the melted mixture into suitable shapes or forms for linings.

4. A cupola provided with an adjustable weighted valve to retain any desired pressure of gases within its interior.

JACOB REESE.

Witnesses:
FRANK M. REESE,
WALTER REESE.