

(No Model.)

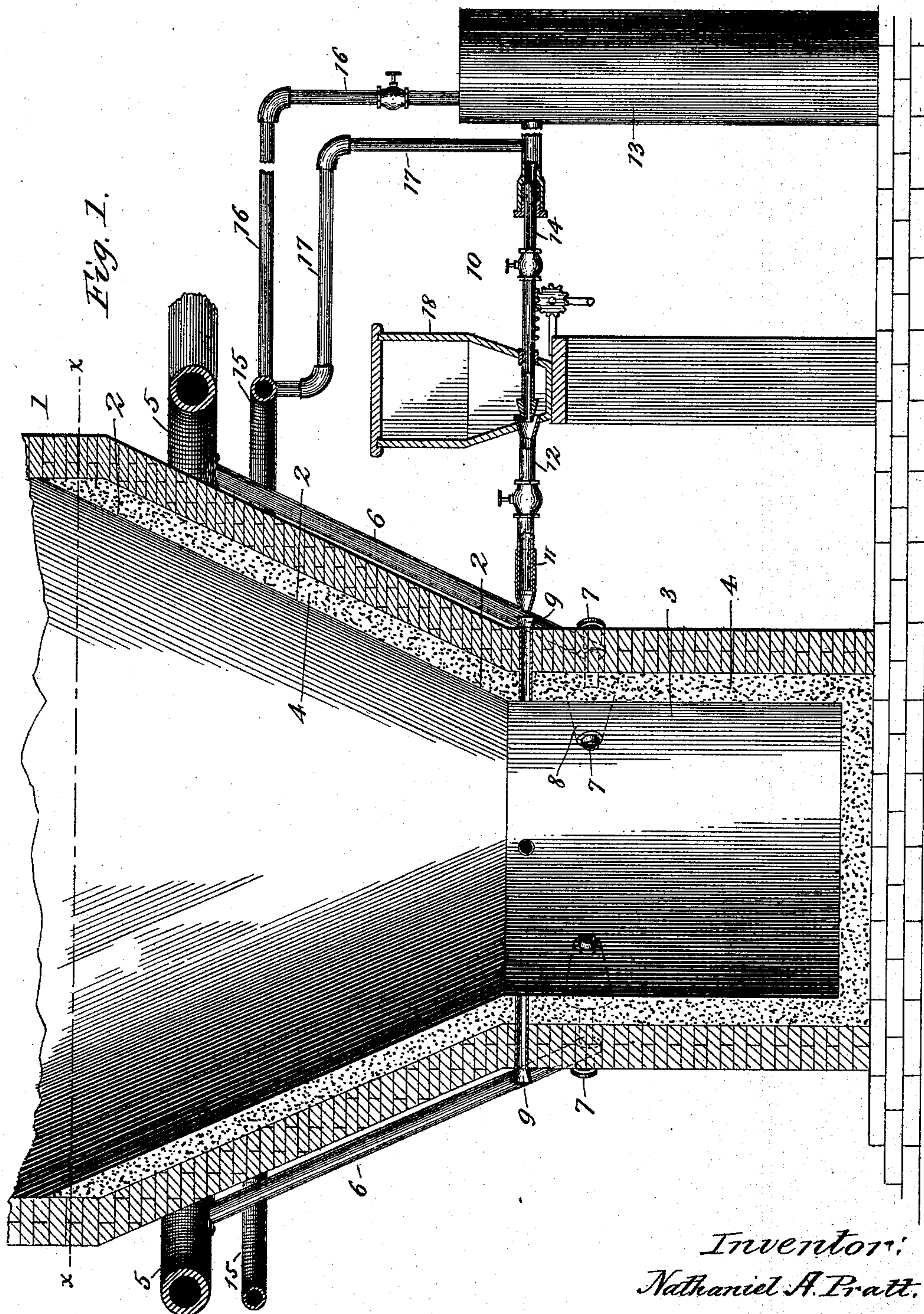
2 Sheets—Sheet 1.

N. A. PRATT.

APPARATUS FOR SMELTING ORES.

No. 413,551.

Patented Oct. 22, 1889.



Witnesses:
T. H. Stuart
J. J. Lecher

Inventor:
Nathaniel A. Pratt.
By Marble & Mason,
Attys.

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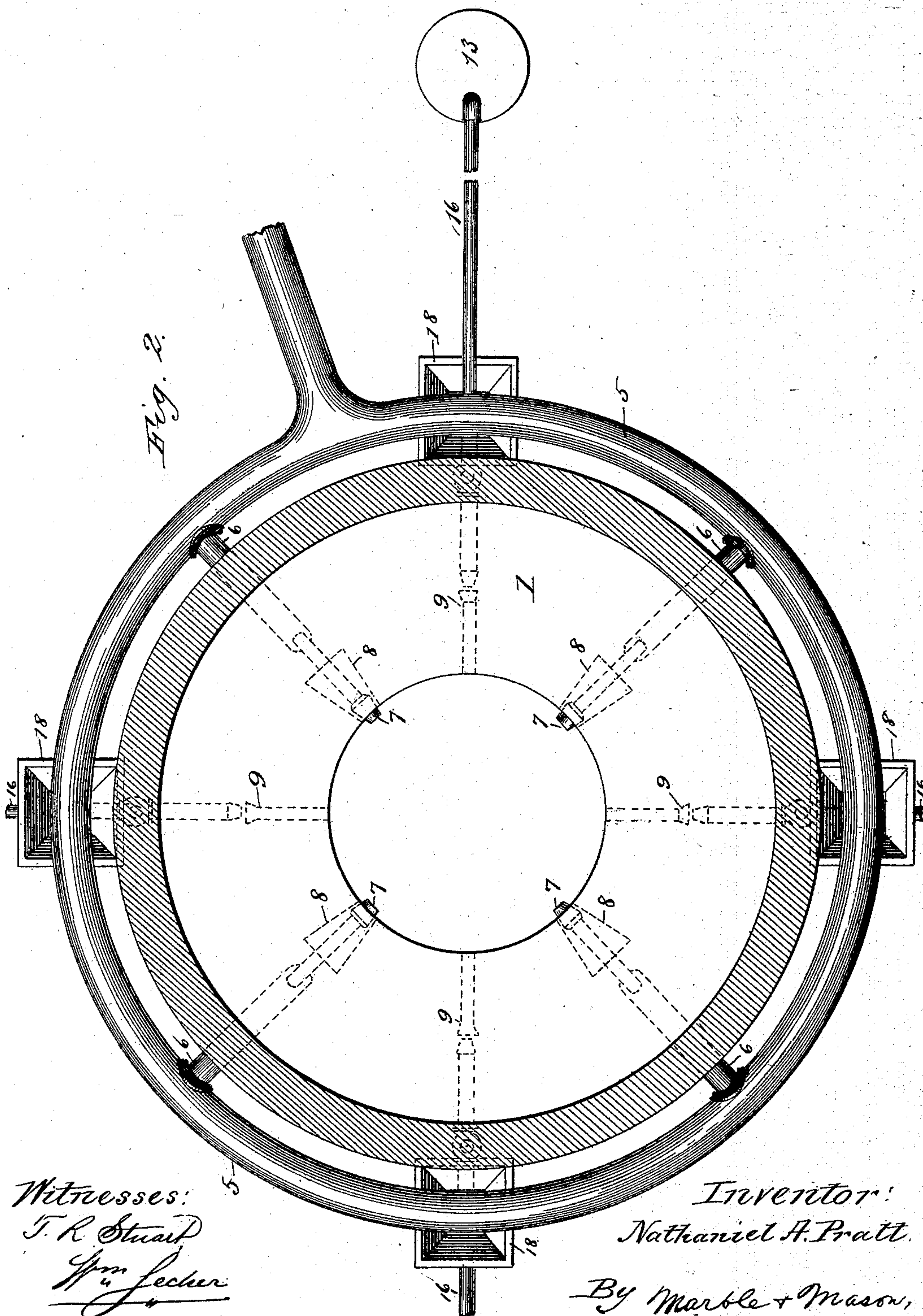
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UNITED STATES PATENT OFFICE.

NATHANIEL A. PRATT, OF ATLANTA, GEORGIA, ASSIGNOR TO THE PRATT STEEL COMPANY, OF BIRMINGHAM, ALABAMA.

APPARATUS FOR SMELTING ORES.

SPECIFICATION forming part of Letters Patent No. 413,551, dated October 22, 1889.

Application filed June 2, 1888. Serial No. 275,942. (No model.)

To all whom it may concern:

Be it known that I, NATHANIEL A. PRATT, a citizen of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have invented certain new and useful Improvements in Apparatus for Smelting Ores; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to apparatus for smelting ores and dephosphorizing and otherwise purifying and refining metals; and it consists in the improved construction and arrangement or combination of parts, hereinafter fully disclosed in the description, drawings, and claims.

The objects of my invention are, first, to provide smelting or blast furnaces with improved means for introducing the necessary flux, in a finely-comminuted condition, into the charge at or near the zone of fusion in the lower part of the boshes, and, second, to provide in connection with such means a furnace having a basic lining for the boshes and crucible. I accomplish these objects by the apparatus shown in the accompanying drawings, forming part of this specification, and in which the same reference-numerals indicate the same parts.

Figure 1 represents a vertical section of a portion of my improved furnace and of one of the flux feeders or injectors, and Fig. 2 a horizontal section of the same on the line xx of Fig. 1.

In the drawings, the numeral 1 indicates the furnace, which may be of any suitable or preferred general construction, but which has the boshes 2 and the crucible 3, provided with a lining 4, of any suitable basic compound which does not contain any silicious or aluminous matter or any similar acid. The bustle or blast-pipe 5 surrounds the furnace, and is provided with the usual drop-pipes 6, which connect with the nozzles 7 and tuyeres 8 at their lower ends, said tuyeres and nozzles entering the furnace at the lower part of the boshes.

The furnace is provided with flux-nozzles 9, which are preferably arranged about one

foot above the tuyeres and around the furnace at equal distances apart; but I do not wish to be limited to this exact location of said flux-nozzles, as they may be placed slightly below the tuyeres and still effect in degree the same result as when employed above them. A suitable number of flux-feeders are also arranged around and mounted near to the furnace, and each one is connected with one of the flux-nozzles 9 by a sliding or other suitable coupling 11, which is fitted upon the outlet-pipe 12 of said flux-feeder. Each feeder may either be operated by compressed air forced directly from the air-receiver 13 through the pipe 14 or from the air-distributing pipe 15, which surrounds the furnace below the bustle or blast-pipe 5, as shown, and which may be supplied with compressed air either from an air engine or compressor (not shown) or from the reservoir through a pipe-connection 16 into the distributing-pipe 15, thence through a pipe 17, connected to the pipe 14 in rear of the flux-feeder, and thence through the hopper 18 of said feeder.

While I have herein shown and described the flux feeders or injectors as adapted to be operated by compressed air, I do not wish to be limited in this respect, as it is obvious that they may be of any suitable desired construction, and may be operated and regulated entirely by a blast of highly-compressed air; or any suitable mechanical means may be used which will feed the finely-comminuted flux into the blast-pipe for carrying it into the furnace against the outward pressure of the blast from the blowing-engine or other source. However, while I do not limit myself in this regard, the construction of flux-feeders herein disclosed is well adapted for attainment of the result desired, and forms the subject of a separate application for Letters Patent filed simultaneously herewith.

The operation of my improved apparatus is as follows: The stack of the furnace is charged with ore and fuel in the usual manner, without, however, charging limestone-flux mingled with said ore and fuel, as is usually done. If desired, flux may be charged with the ore and fuel; but this is neither necessary nor desirable in my apparatus, as the flux adds nothing

to the metallurgical reactions of the upper part of the furnace, and only occupies space in the stack which may be employed to better advantage by being occupied by ore. When the furnace is "blown in" or put into operation, and as soon as the proper heat has been attained, a sufficient amount of the pulverized flux is fed through the flux-nozzles in constant streams, and forms, by its chemical action upon the clay and silica of the ore and fuel, the most fusible slag or cinder. Then as the metal commences to drip from the ore the charge of flux is increased, the larger portion of it being arrested in the zone of fusion, where its activity or effect is exerted under the best conditions on the molten globules, while a sufficient portion thereof is diffused upward into the upper boshes to slag off the rougher impurities of the ore and fuel. The basic lining of the boshes and crucible will admit of a perfect dephosphorization and purification of the molten metal without being injured thereby, which is not possible in furnaces having the boshes and crucibles lined with the usual silicious and aluminous fire-proof acid linings, which, under the heat of the furnace, will unite with the flux and neutralize to a great extent the basic reaction of the flux, and thus prevent perfect dephosphorization, desiliconizing, and purification of the metal, which demand the absence of all reducible silicates and silicious matters. Also, by introducing the basic flux in a finely-comminuted state into the lower part of the boshes at or near the zone of fusion, said flux will retain all its properties unimpaired and will produce the proper and desired basic reaction at the point where it is required. Also, under these conditions a much smaller amount of flux will be required, whereas flux fed in at the top of the stack in lumps, together with the ore and fuel, will, by passing down through zones of gradually-increasing heat, form a highly silicious and refractory slag, lose a large percentage of its basic properties before reaching the zone of fusion, and will not come into intimate contact with the metal, thus effecting neither dephosphorization nor purification of the metal, which will then require further treatment, after it is drawn from the furnace, in the ordinary open-hearth furnace, refiner, or converter.

Having thus fully described the construction and arrangement or combination of parts of my improved apparatus, its operation and advantages, what I claim as new is—

1. In an apparatus for smelting ores and dephosphorizing and otherwise purifying and refining the molten metal, the combination, with a blast-furnace provided with a basic lining for its boshes and crucible, of an apparatus for feeding finely-comminuted basic flux into the lower part of the boshes at or near the zone of fusion, substantially as described.

2. In an apparatus for smelting ores and dephosphorizing and otherwise purifying and refining the molten metal, the combination, with a blast-furnace provided with a basic lining for its boshes and crucible, of a series of flux-feeders arranged around said furnace for feeding finely-comminuted basic flux thereto and having their nozzles entering the lower part of the boshes a short distance above the tuyeres, substantially as described.

3. In an apparatus for smelting ores and dephosphorizing and otherwise purifying and refining the molten metal, the combination of a blast-furnace provided with a basic lining for its boshes and crucible, and with flux-nozzles around the lower part of its boshes, with feeders arranged to register with said nozzles and provided with movable couplings for connecting them therewith, substantially as described.

4. In an apparatus for smelting ores and dephosphorizing and otherwise purifying and refining the molten metal, the combination of a blast-furnace provided with a basic lining for its boshes and crucible, and with flux-nozzles arranged around the lower part of its boshes, with feeders or injectors arranged to register with said nozzles and provided with delivery-pipes and movable couplings for connecting them with said nozzles, and a compressed-air-supplying reservoir for forcing said flux through said nozzles, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

NATHANIEL A. PRATT.

Witnesses:

T. R. STUART,
WM. LECHER.