

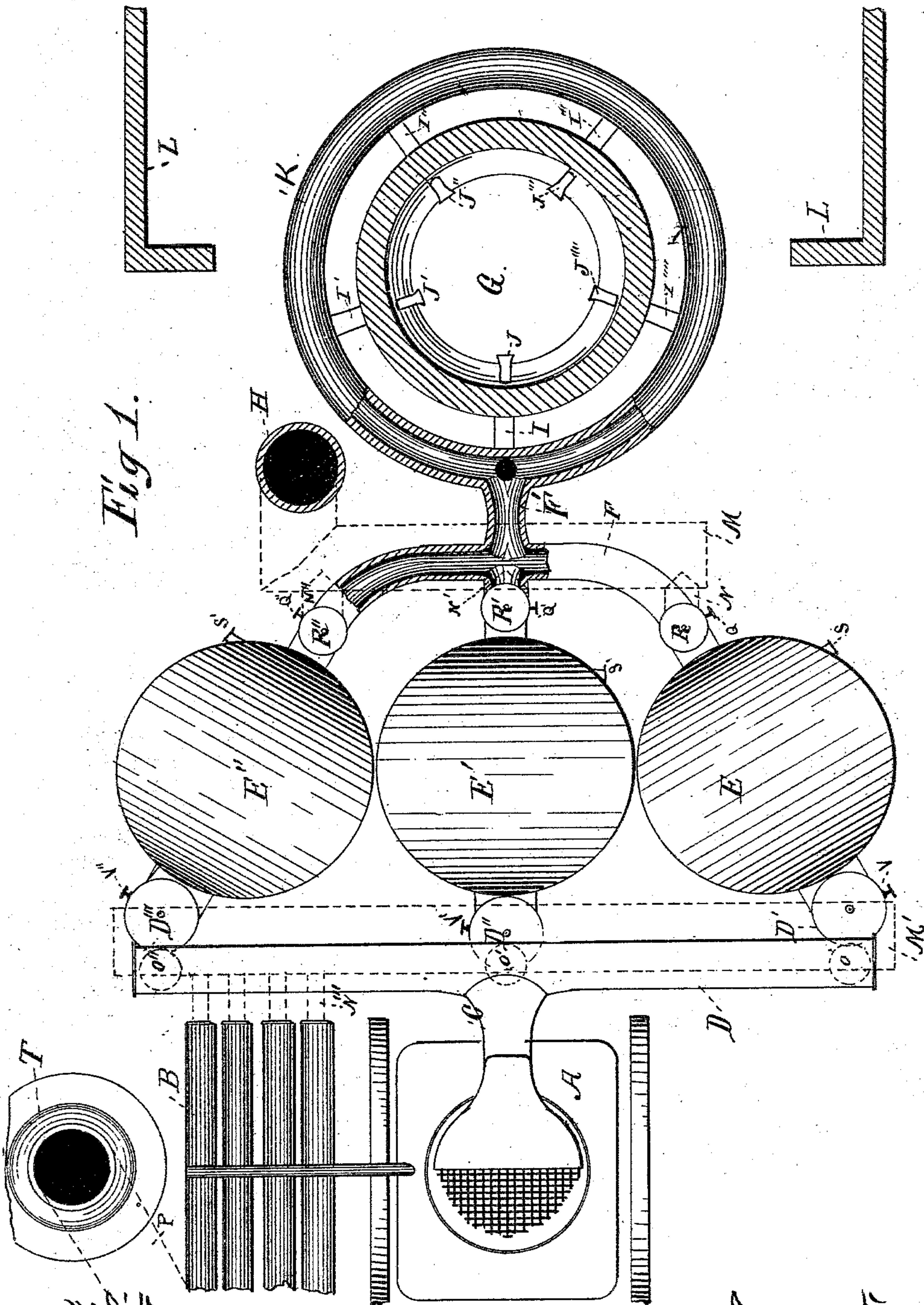
(No Model.)

2 Sheets—Sheet 1.

J. F. BENNETT.
BLAST FURNACE ACCESSORY.

No. 303,205.

Patented Aug. 5, 1884.



WITNESSES.
H. H. H. H. H.
Alex. H. H. H.

Inventor.
John Francis Bennett,
J. H. Adriaans
Attorney

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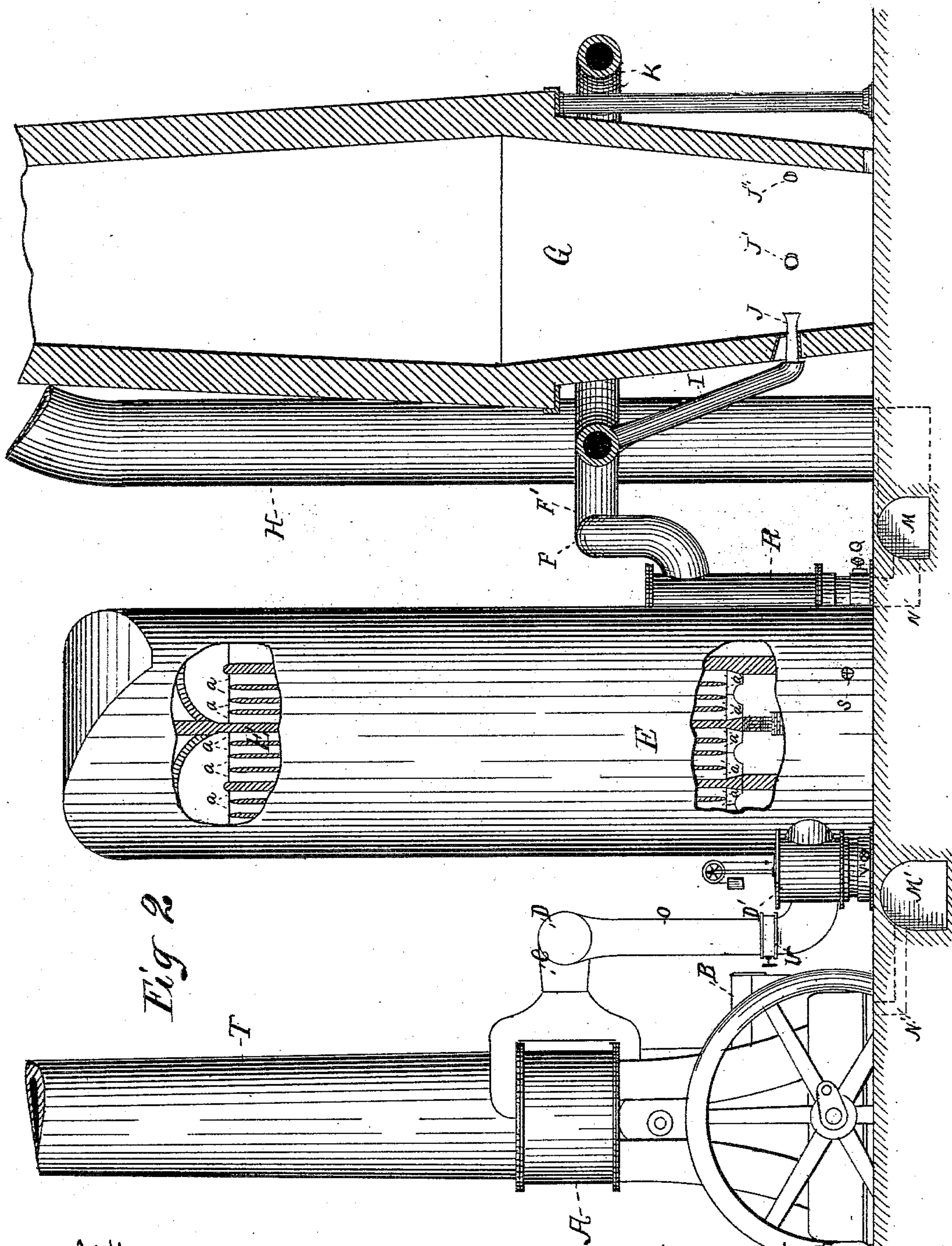


Fig. 2

Witnesses.
M. A. Hanson.
A. C. Randall.

Inventor.
John Francis Bennett.
J. H. Adriaans
Attorney

UNITED STATES PATENT OFFICE.

JOHN F. BENNETT, OF PITTSBURG, PENNSYLVANIA.

BLAST-FURNACE ACCESSORY.

SPECIFICATION forming part of Letters Patent No. 303,205, dated August 5, 1884.

Application filed September 24, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOHN FRANCIS BENNETT, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Blast-Furnace Accessories; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form part of this specification.

My invention relates to improvements in blast-furnace accessories in which means are provided for conveying a heated blast to the furnace; and the object of my improvements is to provide economically a continuous heated blast to be charged to the furnace. I attain this object by the methods hereinafter described, and the means illustrated in the accompanying drawings, in which—

Figure 1 represents a plan view, partly in section, of the plant essential to the successful operation of my invention; and Fig. 2 is an elevation thereof, partly broken and in section.

Similar letters refer to corresponding parts in both views.

A represents a blower, whose piston is operated by a crank-and-lever connection, to which motion is imparted by steam from the boilers B by means of the crank-shaft.

B is a series of boilers heated by the waste gases from the blast-furnace G, through downcomer H, flues M N, stop-valves Q Q' Q'', pipes R R' R'', stoves E E' E'', pipes D' D'' D''', valves V V' V'', flues M' N'. When the boilers have deprived these gases of their heat they are discharged into the atmosphere by flue P and shaft T.

C is a branch pipe connecting the blower end with the pipe D. It will be noticed that this pipe forms a frustum of a cone, which shape secures the least friction by the passing air. D is a pipe receiving atmospheric air from the blower A through pipe C, which it delivers alternately in pairs to the stoves E E' E'' by the valves V V' V'' in the pipes D' D'' D'''. The entrance and exits of the air into and from the pipe are rounded to avoid frictional resistance.

E E' E'' are stoves in which the atmospheric

air from the blower is heated, on its passage to the furnace G, by contact with the flues previously heated by the furnace-gases. I do not restrict myself to the use of three stoves, but find that number admirably adapted to carry out the end aimed at. All the inlets and exits of the stove are rounded, as also the flues *a a a* and walls, whereby obstruction to the passage of the hot gases is obviated.

F is the hot-air main connected with the stoves E E' E'' by pipes R R' R'', having valves Q Q' Q'', and with the bustle-pipe K by pipe F'. At the point of curvature the area is enlarged to approximately twice that of the main body of the pipe. The entrances to and exits from the pipe are rounded, whereby no decrease in the velocity of the passing heated air results.

F' is a pipe connecting the pipe F with the bustle-pipe K. It is shaped like two frusta of cones united at their smaller bases.

G represents the blast-furnace. H is a downcomer conducting the hot gases from the top of the furnace to the underground flue M.

I I' I'' I''' I'''' are drop-pipes connecting the bustle-pipe K with the tuyeres J J' J'' J''' J'''. The entrances and exits of these pipes are shaped like conical frusta, thus offering no resistance to the passing air.

K represents the bustle-pipe. It is concentric with the blast-furnace, and has at intervals drop-pipes I I' I'' I''' I''', by which the heated atmospheric air it receives from the pipes F' is fed to the furnace by means of tuyeres J J' J'' J''' J'''. L is a section of the casting-house wall.

M is the main underground flue, receiving hot gases from the downcomer H and conducting them to the branch flues N N' N''. M' is a main underground flue receiving the hot gases, partially deprived of their heat, in the stoves, from the pipes D' D'' D''' and their valves V V' V'', and conducting them through flues N''' beneath the boilers B.

O O' O'' are three drop-pipes from the pipe D to the pipes D' D'' D'''. Its entrances and exits are formed like conical frusta and the areas at the points of curvature enlarged. P is a flue conducting the waste gases, after all their heating-power has been abstracted, to the shaft T.

Q Q' Q'' are two-way valves leading either the hot gases from the furnace into the stove, through branch pipes N N' N'' and pipes R R' R'', or conducting the heated air out of the stove by pipes R R' R'' into the pipe F.

S S' S'' are slide or other cold-air inlet-valves, insuring the supply of air necessary to secure perfect combustion of the furnace-gases in their passage through the stoves.

T is the chimney, discharging the waste gases incapable of further economical utilization.

U is the air-blast valve in pipe O.

It will be appreciated that air or gas having a temperature varying from 1,000° to 3,000° Fahrenheit has an enormous velocity. Any obstruction or hinderance between the source and the point of utility affects proportionately its value at that point; hence I have so constructed a blast-furnace plant that the entrances to and exits from blower, pipes, stoves, and tuyeres are all shaped like conical frusta, and sometimes uniting two frusta at their smaller bases. By this means the resistance to the passage of the air or gases is practically obviated, and I am enabled, to that extent, to increase their utility.

Although I have advised that the whole of the blast-furnace waste gases be caused to pass through the hot stoves, yet there are in existence many plants whose hot stoves are so restricted in their air-passages that they could not economically (I mean without added pressure of blast) receive the whole of the gases. In such cases the principle of my invention may be modified by forcing or drawing as much of the gases as can be economically passed through the stoves, and directing the remainder from the blast-furnace gas-main flue or receiver under the boilers, in which case atmospheric air to the equivalent extent of the gases must be added thereto at their entrance under the boilers to maintain combustion. The best modern blast-furnaces have hitherto required from one to one and a half ton of the best coke fuel to produce a ton of

pig-iron. I propose, by the application of my improvements, to increase the heat at the zone of fusion in a blast-furnace, so that three-quarters of a ton of the best coke fuel will make a ton of pig-iron, in which case all or nearly all of the gases will require to be burned in the stoves to raise the air afterward passing through to the required temperature.

I am aware that heretofore hot-blast stoves have been used with blast-furnaces for the purpose of heating the air-blast by means of the waste gases from the furnaces. My invention consists in the improved means whereby this object is attained, as specifically set forth in the claim.

Having thus fully described my invention, together with an account of the principles involved, and means for advantageously utilizing these principles, what I claim, and desire to secure by Letters Patent of the United States, is—

The blower A, having a bell-mouthed exit for the air, pipe C, shaped like a conical frustum, pipes D D' D'' D''', two-way valves V V' V'', stoves E E' E'', pipes R R' R'', containing two-way valves Q Q' Q'', pipes F F', having enlarged areas at points of curvature, bustle-pipe K, drop-pipes I I' I'' I''', enlarged at the respective ends, and flaring tuyeres J J' J'' J''' J''', in combination with the blast-furnace G, having downcomer H, enlarged at the respective junctions with the wall of the furnace and with that of the flue, flues M N N' N'', valves S S' S'', flues M' N'', boilers B, flue P, and shaft T, the whole for the purpose of diminishing the friction of the heated and hot gases to and from the furnace.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

JOHN F. BENNETT.

Witnesses:

H. E. HARRISON,
ALEX. RANDOL.