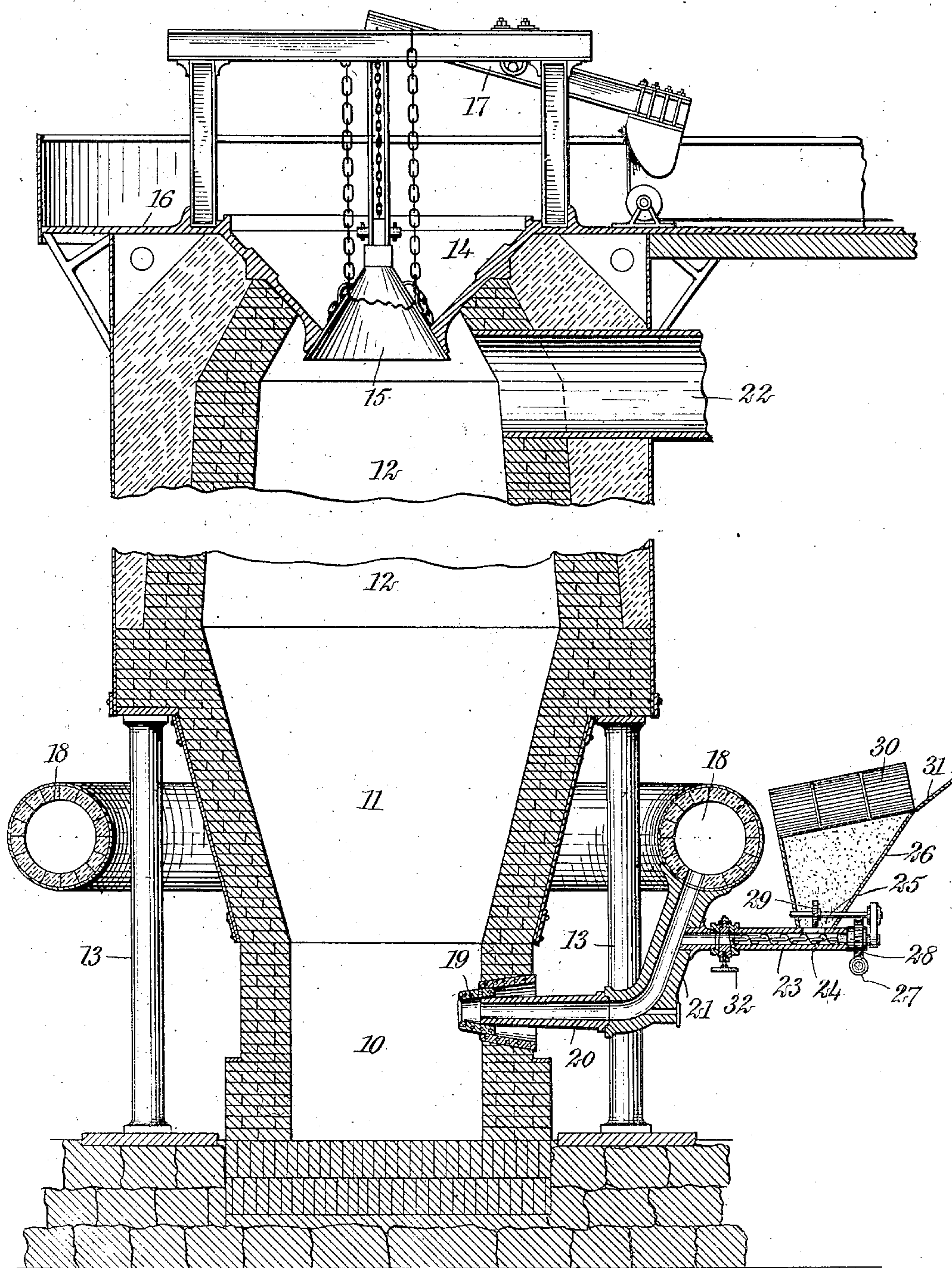


E. L. HARPER, JR.
 APPARATUS FOR FEEDING FLOUR IRON ORE TO BLAST FURNACES.
 APPLICATION FILED APR. 8, 1908.

914.830.

*Patented Mar. 9, 1909.



WITNESSES

Frederick G. Hackenberg

C. W. Fairbank

INVENTOR

Edward L. Harper Jr.

BY *Mum Co*

ATTORNEYS

UNITED STATES PATENT OFFICE.

EDWARD L. HARPER, JR., OF BIG STONE GAP, VIRGINIA.

APPARATUS FOR FEEDING FLOUR IRON ORE TO BLAST-FURNACES.

No. 914,830.

Specification of Letters Patent.

Patented March 9, 1909.

Application filed April 8, 1908. Serial No. 425,954.

To all whom it may concern:

Be it known that I, EDWARD L. HARPER, Jr., a citizen of the United States, and a resident of Big Stone Gap, in the county of Wise and State of Virginia, have invented new and useful Improvements in Apparatus for Feeding Flour Iron Ore to Blast-Furnaces, of which the following is a full, clear, and exact description.

10 This invention relates to certain improvements in the apparatus for feeding of flour iron ore, that is, ore in an extremely fine state of subdivision, to blast furnaces, in such a manner that it will not be blown out immediately by the blast, but will become amal-

15 gamated with the molten or fused mass in the bosh of the furnace.

In the ordinary type of blast furnace, ore, fuel and limestone are fed to the furnace through the hopper at the upper end thereof, upon the opening of the bell, but due to the strong blast of air forced into the furnace at the lower end thereof and the strong current of gas escaping through the gas outlet pipe or down-take, a large portion of the fine ore is blown out of the furnace and cannot be smelted. In fact, such a large quantity of this fine ore or dust is blown out of the furnace, that it is necessary to provide dust

25 catchers, wherein this fine ore or dust may separate from the blast furnace gases. It is needless to return this dust or flour ore to the hopper for re-charging in the furnace, for as soon as it enters the furnace it will be immediately blown out again. This dust accumulates in enormous quantities, and even though it is very rich in iron, yet at the present day it is considered of no value, due to the inability to economically smelt the same.

40 In the working of my invention, I remove the flour ore from the dust catcher and return the same to the furnace at such a point that it cannot be blown out again. That is, I return it directly to the zone of fusion, where it is immediately amalgamated or melted before the blast can remove it through the down-take.

My invention consists in the means employed for forcing the flour ore above referred to directly into the air pipe connecting the bustle pipe and twyer and above the peep hole, the forcing means being so constructed that the rate at which the ore is fed may be varied at will or may be stopped entirely

55 without air escaping through the ore-delivery means.

Reference is to be had to the accompanying drawings, showing a blast furnace in vertical section with my improved mechanism connected thereto.

My improved mechanism may be used in connection with any blast furnace whatsoever, but for purposes of illustration I have shown an ordinary type of blast furnace, having a crucible 10, a bosh 11, and a stack or column 12. The stack is supported by suitable columns 13, and is fed at its upper end through a hopper 14, which may be closed by a vertically-movable bell 15. Adjacent the hopper is a suitable platform 16, along which the ore may be conveyed for dumping into the hopper, and there is provided suitable mechanism, including a lever 17, for operating the bell.

Surrounding the furnace, adjacent the bosh, is an air-distributing pipe or bustle pipe 18. Below the bosh any suitable number of twyers 19 may be provided, each of which is connected to the bustle pipe by a conduit, including a horizontally-disposed portion or blow pipe 20 and an inclined or leg pipe 21. The air which is delivered from the bustle pipe to the twyers comes into contact with the molten material and serves to support the combustion of the fuel. The nitrogen in the air and the gases generated within the furnace, rise through the material in the stack, carrying all dust and finely subdivided ore to the upper end and force them out of the furnace through a gas outlet or down-take 22. The down-take leads to a dust catcher, not shown, where the dust is separated from hot gases before the latter are conducted to burners, engines, or storage tanks.

None of the features thus far described, constitute any portion of the invention hereinafter claimed, inasmuch as they may all be constructed in accordance with common practice.

In the specific mechanism illustrated for carrying out my invention, I provide a conduit, casing, or shell 23, having a rotary conveyor 24, mounted therein, and having one end thereof in communication with the leg pipe 21 leading from the bustle pipe 18. At or adjacent the rear end of the casing or conduit 23, there is provided an entrance opening 25, through which the fine flour ore or dust is received from a hopper 26. The screw conveyor 24 may be operated in any suitable manner, as, for instance, by a worm 27, en-

gaging with a worm wheel 28 at the end of the casing. A suitable agitator 29 may, if desired, be provided within the hopper at the lower portion thereof, to prevent the material from collecting at the entrance opening 25, and this agitator may be operated from the shaft of the screw conveyer. In order to prevent the large particles from passing into the conveyer or the air pipe, I may, if
10 desired, provide a rotary cylindrical screen 30, receiving the material from a chute 31 leading to the interior of the cylinder and delivering the coarser particles out at the opposite end of the cylinder. The detailed construction of the conveyer, hopper and screen
15 may be varied within wide limits, as it is only necessary that coarse ore be eliminated and only the fine ore delivered to the air pipe. When it is not desired to employ this ore-
20 feeding mechanism, the escape of air through the same may be prevented by the closing of a suitable valve 32, adjacent the intersection of the pipe 21 with the casing 23.

The ore, fuel, &c., are fed to the furnace in
25 the ordinary manner, and; in fact, the operation is conducted according to well-known practice, except that the flour ore which collects in the dust catcher, instead of being thrown away as valueless, is conveyed to the
30 hopper 26 and forced into the air pipe at such

a rate as to be conveyed into the furnace below the upper limits of the zone of fusion. The flour ore here immediately amalgamates with the molten or semi-molten material, and its passage upward through the bosh and
35 stack with the gases, is prevented.

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

In combination with a blast furnace, a
40 bustle pipe, a twyer, an air pipe connecting said bustle pipe and said twyer and having a substantially horizontally-extending portion and a substantially vertically-extending portion, a conduit extending substantially hori-
45 zontally and connected to said air pipe intermediate the ends of the vertically-extending portion of the latter, a screw conveyer within said conduit, a cut-off valve intermediate the end of said conveyer and said air pipe, and a
50 hopper adjacent the outer end of said conduit and communicating with the interior of the latter.

In testimony whereof I have signed my name to this specification in the presence of
55 two subscribing witnesses.

EDWARD L. HARPER, JR.

Witnesses:

CLAIR W. FAIRBANK,
JOHN P. DAVIS.