P. HAIG.

BLAST FURNACE.

APPLICATION FILED SEPT. 15, 1919.

1,335,494.

Patented Mar. 30, 1920.

3 SHEETS—SHEET 1.

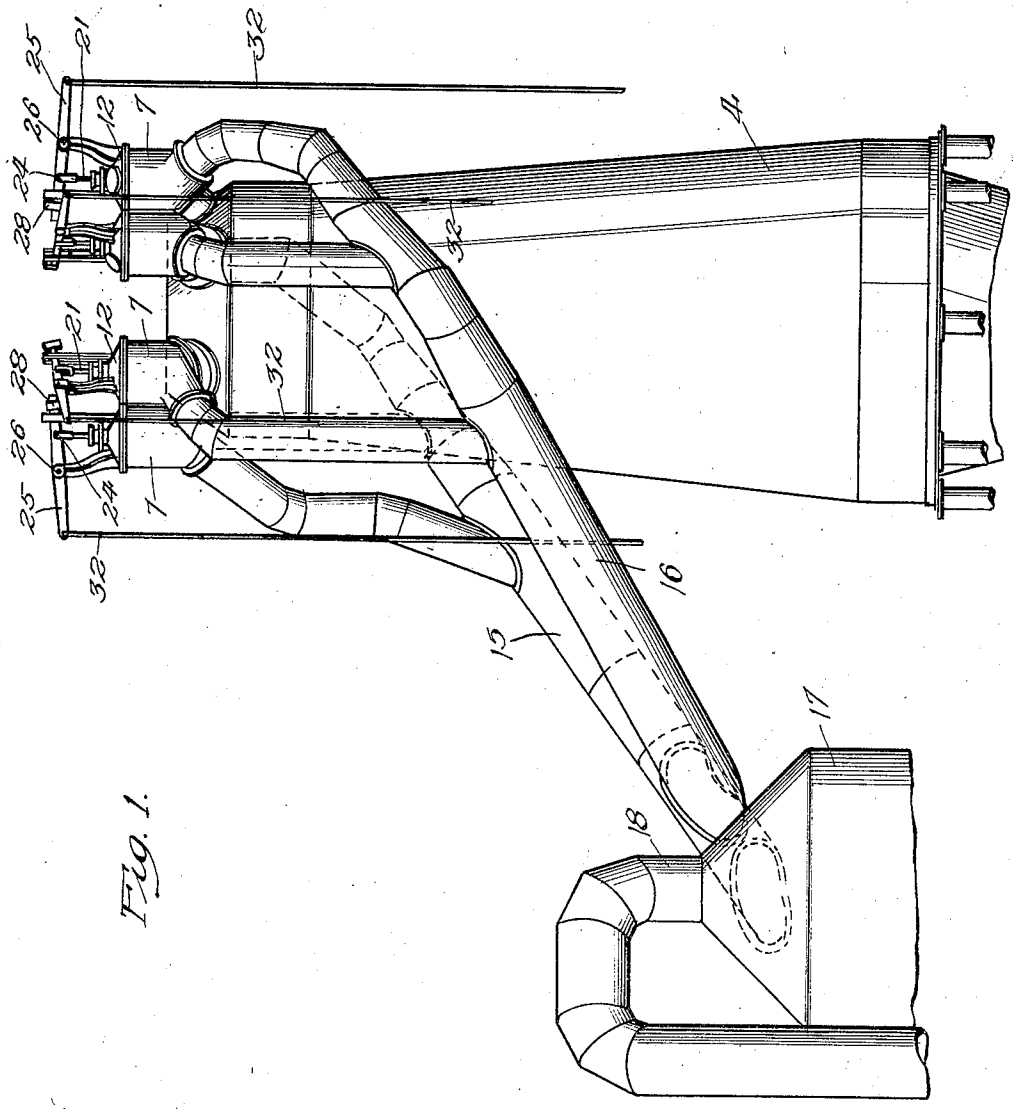


Fig. 1.

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Inventor:
Paul Haig
by Dyrenforth, Lee, Chritton & Wiles Atty's:

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3 SHEETS—SHEET 2.

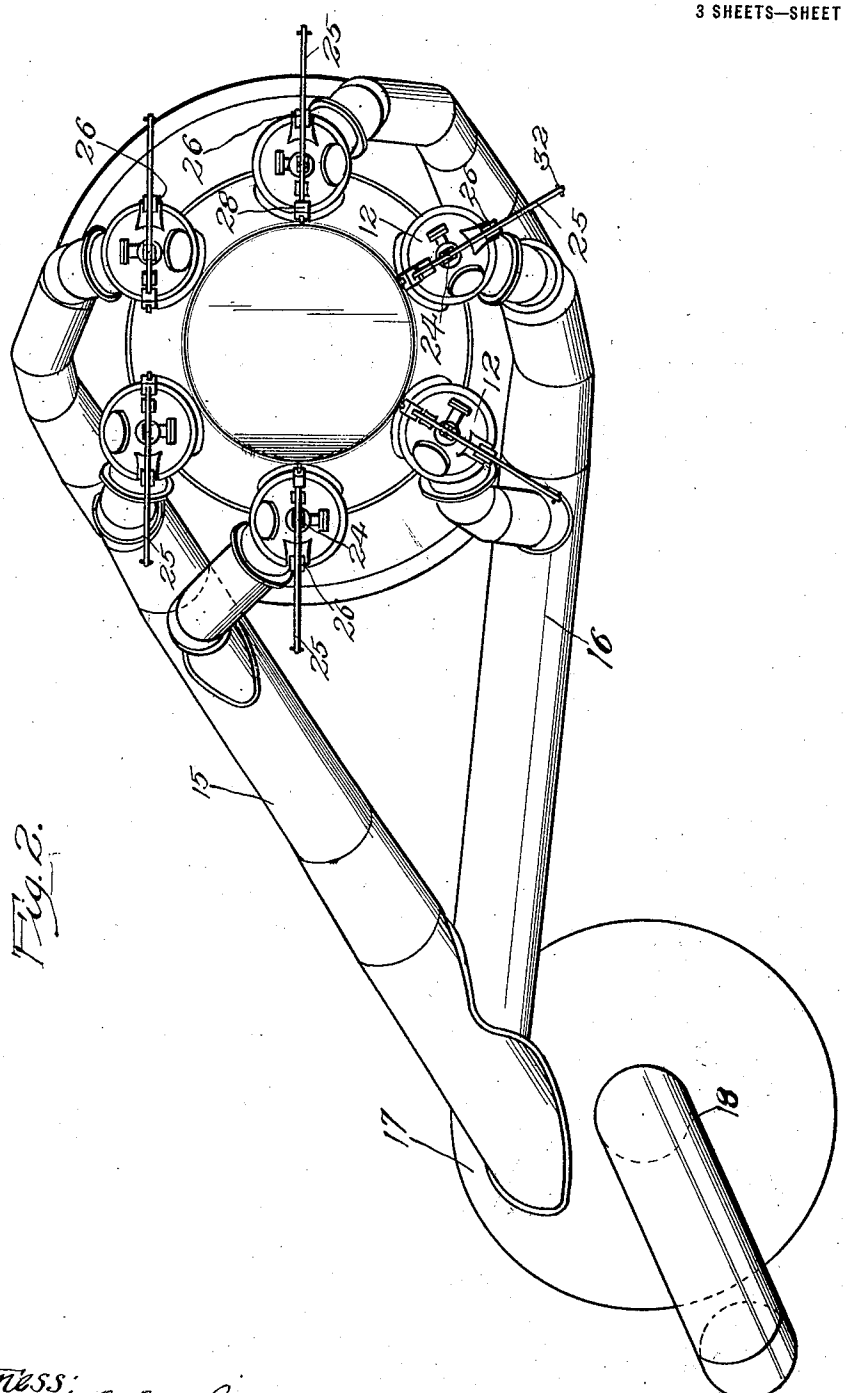


Fig. 2.

Witness:
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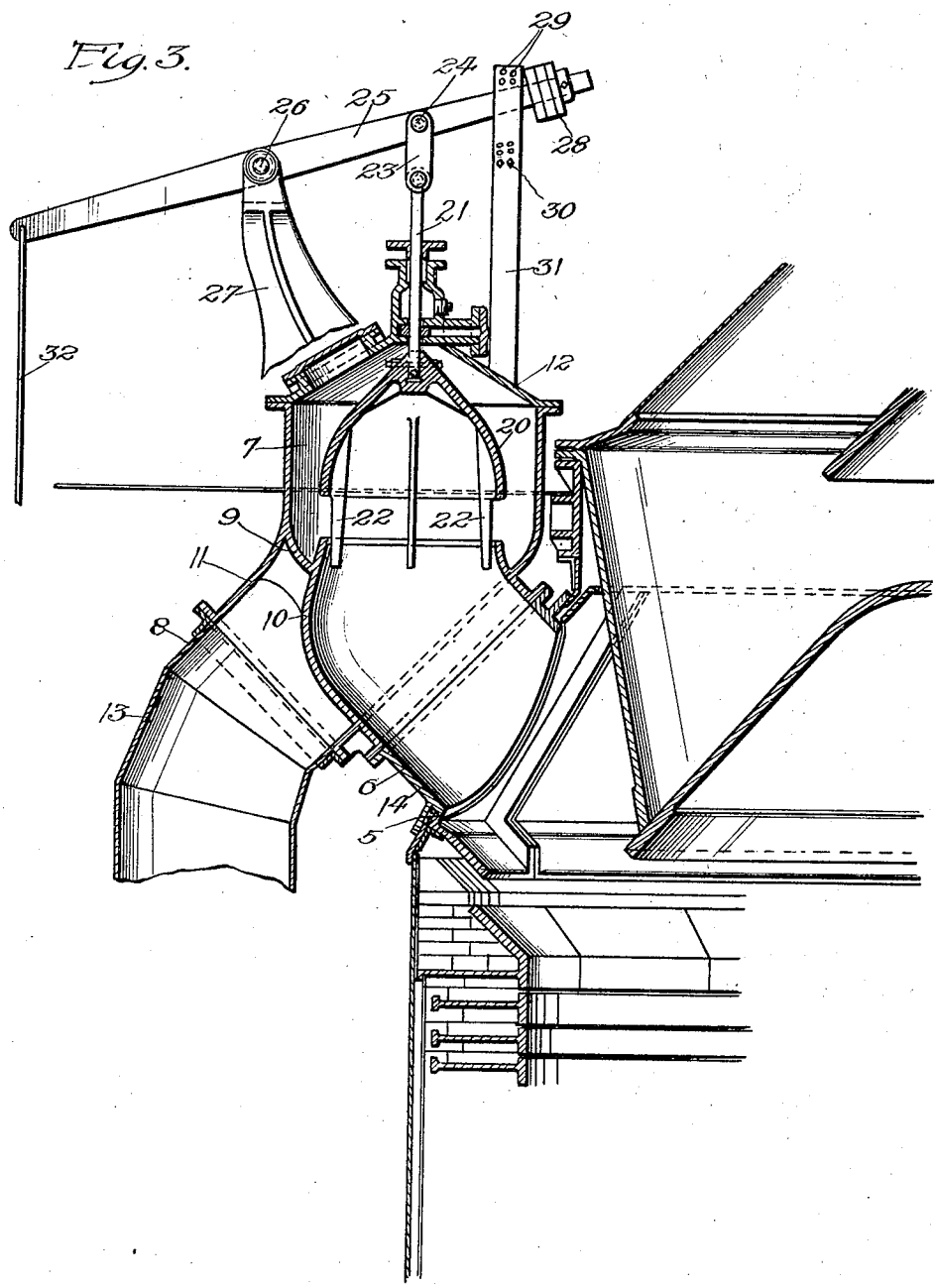
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3 SHEETS-SHEET 3.

Fig. 3.



Witness:
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UNITED STATES PATENT OFFICE.

PAUL HAIG, OF CHICAGO, ILLINOIS.

BLAST-FURNACE.

1,335,494. Specification of Letters Patent. Patented Mar. 30, 1920.

Application filed September 15, 1919. Serial No. 323,896.

To all whom it may concern:

Be it known that I, PAUL HAIG, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Blast-Furnace, of which the following is a specification.

My primary objects are to reduce to the minimum danger to the workmen and injury to the furnace and prevent wastage of raw material (ore, fuel, etc.) and gas evolved in the operation of the furnace, in the event of so-called "slippage" of the furnace; to provide for the positive control of the outflow of gas from the furnace; to provide for the diverting from one side of the furnace to the other at will, under the control of the operator, of the currents of gas to cause the gas to be diverted to either side of the furnace, as desired, for causing the deterioration of the walls of the furnace, under the action of the heated gas, to be more nearly uniform, as distinguished from localized, and thus prolong the operation and life of the furnace; and other objects as will appear from the following:

Referring to the accompanying drawings—

Figure 1 is a view in elevation of an apparatus constructed in accordance with my invention; Fig. 2 is a plan view of the same; and Fig. 3, a broken view, almost entirely sectional, of the upper portion of the blast furnace, the section being taken through one of the gas outlets.

In the apparatus shown, 4 represents a blast furnace provided with a plurality of openings 5, one only of which is shown, there being six of these openings in the particular arrangement illustrated, equi-distantly spaced apart around the top of the furnace, though the number of these openings may be varied as desired. The openings 5 communicate with pipes 6 which extend upwardly therefrom, and at their upper ends open through the side walls of the upper portions of pipes 8 forming down-comers, the upper ends of the pipes 8 forming in effect chambers 7 of preferably enlarged cross-section, with covers 12, and the upper ends of the pipes 6 which are preferably upwardly tapering and thus frusto-conical as shown, being spaced from the side walls of the portions of the pipes 8 into which they extend, as stated, with spacing ribs 9 interposed between them. In the particular arrangement shown, the upper portions of the pipes 6 and 8, represented at 10 and 11, respectively, and the spacing ribs 9, are formed as an integral casting, the lower portions of the pipes 6 and 8 being represented at 13 and 14, respectively.

The down-comers 8 form the outlets 5 at one side of the furnace structure, in the furnace illustrated three adjacent ones of these down-comers being connected with a header pipe 15 and the down-comers for the outlets 5 at the opposite side of the furnace being connected with a header pipe 16, the header pipe 16 opening into the pipe 15 and the latter opening into the top of a dust-catcher 17 which may be of any suitable type, and which is provided with a gas-outlet pipe 18 at its upper end which, in practice, would, by preference, lead to a gas-washer (not shown) and from thence to storage or its place of use, as desired. The gas-passage at a point between the dust-catcher and the point at which it connects with the storage tank or the apparatus where it is to be used, by preference, is provided with a bleeder-valve of any desirable construction, which preferably is located between the point of gas storage or use and the gas-washer.

Each gas outlet from the furnace is equipped with valve means controlling the flow of gas therefrom, and in the particular arrangement shown serving as a means for returning to the interior of the furnace solid particles, particularly of the larger sizes, which are blown from the furnace when "slippages" occur, these valves in the particular arrangement shown being each of the same construction and each involving a bell-shaped valve proper 20 carried on the lower end of a rod 21 vertically slidable in the cover 12, the valve 20 being centralized relative to the upper end of the pipe-section 10 and at its lower edge, which is of the same shape as the upper edge of the pipe-section 10, coöperating with the latter to control the flow of gas therethrough. Guiding means for the valves are provided, these means in the arrangement shown being in the form of ribs 22 which extend downwardly into the upper, open, end of the pipe-sections 10. The upper ends of the rods 21 are equipped with links 23 pivoted thereto and pivotally connected at 24 with levers 25 fulcrumed between their ends

at 26 on brackets 27 rising from the covers 12, the ends of the levers adjacent their connection with the links 23 carrying weights 28 and operating between stops 29 and 30, carried by uprights 31, the stops 30 being shown as in the form of adjustable blocks which may be adjusted into different vertical positions on the uprights carrying them. The other ends of the levers 25 connect with cables 32 which may be wound upon windlasses (not shown) and by means of which the valves 20 may be operated independently of each other to open condition.

It will be understood from the foregoing that the valves 20 may be positioned as shown in Fig. 3 to cause the outlets which they control to be fully open, or they may be weighted by weights 28 to be normally in closed condition, requiring the building up of a predetermined pressure in the furnace before they will open, whereby a predetermined pressure of gas may be carried in the furnace and these valves operate automatically to maintain this pressure, or they may be weighted by the weights 28 to be in partly open condition by the adjustment of the stops 30, or the valves at one side of the furnace or the other, as desired, may be sufficiently weighted to close the gas outlets at either side of the furnace as desired. The capability of the valves for manipulation as last stated is of considerable advantage, especially in case of so-called "hot spots" developing in the furnace walls, in which case the operator by closing the valves at one side or the other of the furnace, as the case may be, may divert the gas from that part of the furnace which has become unduly heated, away therefrom, thereby more nearly equalizing the action of the heated gas on the furnace walls.

The bell-shaped members 20 also serve, by reason of their location relative to the pipe-sections 10, to intercept solid matter discharging from the furnace, and especially relatively large pieces of material blown through the gas outlets in case of "slippages," which fall therefrom and down through the pipe 6 into the furnace chamber from which they discharge, the frusto-conical shape of the upper ends of the pipes 10 being desirable as thereby the particles are caused to be directed toward the center of the valves 20.

The gas discharging from the furnace passes through the gas outlets 5, assuming the valves 20 to be conditioned for permitting of the flow of gas therefrom, and thence into the header pipes 15 and 16, from which they discharge into the upper end of the dust collector, the gas from which the dust has been separated passing through the outlet 18 to the gas-washer referred to and thence to storage, or use, as the case may be. Should excessive gas pressure develop in the furnace and be transmitted to the gas-passages leading therefrom, the bleeder-valve referred to will automatically open and relieve the pressure and prevent impairment of the apparatus.

While I have illustrated and described a particular construction embodying my invention, I do not wish to be understood as intending to limit it thereto as the same may be variously modified without departing from the spirit of my invention, it being my intention to claim my invention as fully and completely as the prior state of the art will permit.

What I claim as new and desire to secure by Letters Patent is:

1. A blast furnace provided at opposite sides thereof with ports forming the outlets through which the gas evolved in the furnace passes therefrom, and means whereby the gas in the furnace may be caused to discharge from the furnace at either side, or both sides, thereof at will.

2. A blast furnace provided at each side with ports forming the outlets through which the gas evolved in the furnace passes therefrom, and means whereby the gas in the furnace may be caused to discharge from the furnace through the gas outlets at either side, or both sides, thereof at will.

3. A blast furnace provided at opposite sides thereof with ports forming the outlets through which the gas evolved in the furnace passes therefrom, and valves in said outlets operable to control the discharge of gas from the furnace at either side, or both sides, thereof at will.

4. A blast furnace provided with a gas outlet and adjustable means for controlling the flow of gas through said outlet to maintain a pressure of predetermined degree in the furnace.

5. The combination with a dust collector, of a blast furnace provided with a port forming the outlet through which the gas evolved in the furnace passes therefrom, said outlet leading into said dust collector, and a valve in said gas outlet.

6. The combination with a dust collector, of a blast furnace provided with a gas outlet leading into said dust collector, and a self-opening valve in said gas outlet movable outwardly when the pressure in the furnace reaches a predetermined degree.

7. The combination with a dust collector, of a blast furnace provided with a gas outlet leading into said dust collector, and a self-opening valve in said gas outlet movable to open position when the pressure in the furnace reaches a predetermined degree, said valve being adjustable to cause it to open under different pressures.

8. The combination with a dust collector, of a blast furnace provided with a gas outlet leading into said dust collector, a valve

in said gas outlet, and a relief valve beyond said gas outlet subjected to the gas in the furnace.

9. The combination with a dust collector, of a blast furnace provided at opposite sides thereof with ports forming the outlets through which the gas evolved in the furnace passes therefrom, said outlets leading into said dust collector, and means whereby the gas in the furnace may be caused to discharge from the furnace and thence into said dust collector, from either side, or both sides, of the furnace.

10. A blast furnace provided with a gas outlet through which the gas evolved in the furnace passes to storage or use, and a valve in said outlet controlling the flow of gas to storage or use located in the path of pieces of solid material discharging from the furnace through said outlet and constructed and arranged to effect the return of such particles through said outlet to the furnace.

11. A blast furnace provided with a gas outlet and a valve of substantial bell shape located in the path of pieces of material discharging from the furnace through said outlet and constructed and arranged to effect the return of such particles through said outlet to the furnace.

12. A blast furnace provided with a gas outlet formed of a pipe leading from the interior of the furnace containing an opening which opens upwardly, and a pipe into which said first-referred-to pipe extends with its top closed, the wall of said opening being spaced from the wall of said second-referred-to pipe, and a valve coöperating with said opening and constructed and arranged to effect the return through said first-referred-to pipe, to the furnace, of pieces of solid material discharged from the furnace through said first-referred-to pipe.

13. A blast furnace provided with a gas outlet formed of a pipe leading from the interior of the furnace containing an opening which opens upwardly, and a pipe into which said first-referred-to pipe extends with its top closed, the wall of said opening being spaced from the wall of said second-referred-to pipe, and a valve of substantial bell shape coöperating with said opening and constructed and arranged to effect the return through said first-referred-to pipe, to the furnace, of pieces of solid material discharged from the furnace through said first-referred-to pipe.

14. A blast furnace provided with a gas outlet through which the gas evolved in the furnace passes to storage or use, and a valve in said outlet and controlling the flow of gas therethrough and opening in the direction of flow of gas through said outlet.

15. A blast furnace provided with a gas outlet formed of a pipe section leading from the furnace and opening upwardly and a second pipe into which said first-referred-to pipe opens, and a valve extending across the open end of said first-referred-to pipe and movable vertically relative to the latter to open said first-referred-to pipe to the discharge of gas therethrough.

16. A blast furnace provided with a gas outlet formed of a pipe section leading from the furnace and opening upwardly and a second pipe into which said first-referred-to pipe opens, and a valve extending across the open end of said first-referred-to pipe and movable vertically relative to the latter to open said first-referred-to pipe to the discharge of gas therethrough, and said valve having depending guide-members which extend into the open end of said first-referred-to pipe for guiding said valve in its movements.

17. A blast furnace provided with a gas outlet formed of a pipe section leading from the furnace and opening upwardly and a second pipe into which said first-referred-to pipe opens, and a valve of general bell shape extending across the open end of said first-referred-to pipe and movable vertically relative to the latter to open said first-referred-to pipe to the discharge of gas therethrough.

18. A blast furnace provided with a gas outlet formed of a pipe section leading from the furnace and opening upwardly with its upper end of reduced diameter and a second pipe into which said first-referred-to pipe opens, and a valve controlling the flow of gas from said first-referred-to pipe into said second pipe.

PAUL HAIG.