R. HÜBNER.

METALLURGICAL FURNACE.

APPLICATION FILED JUNE 8, 1909.

934,532. Patented Sept. 21, 1909.

2 SHEETS—SHEET 1.

FIG. 1.

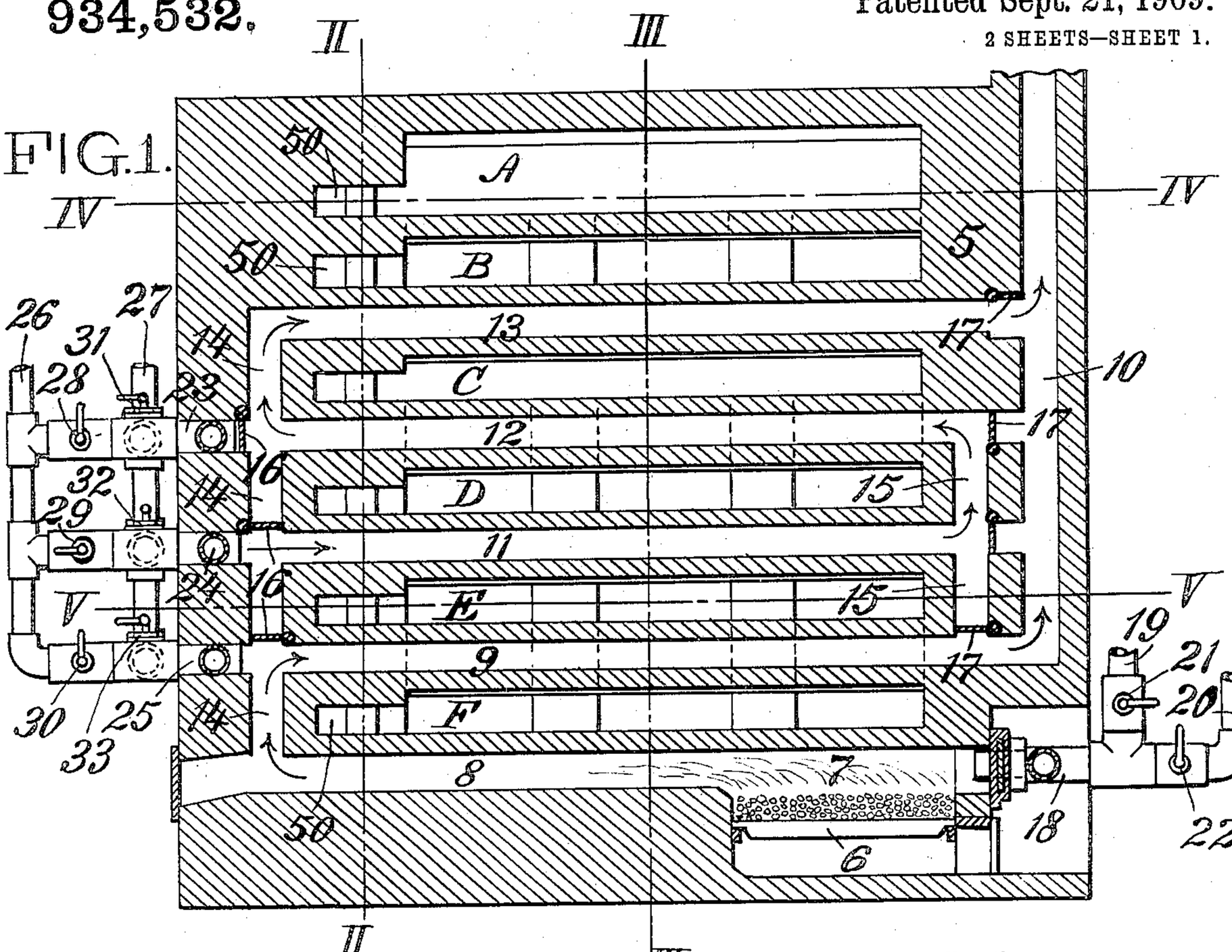


FIG. 2.

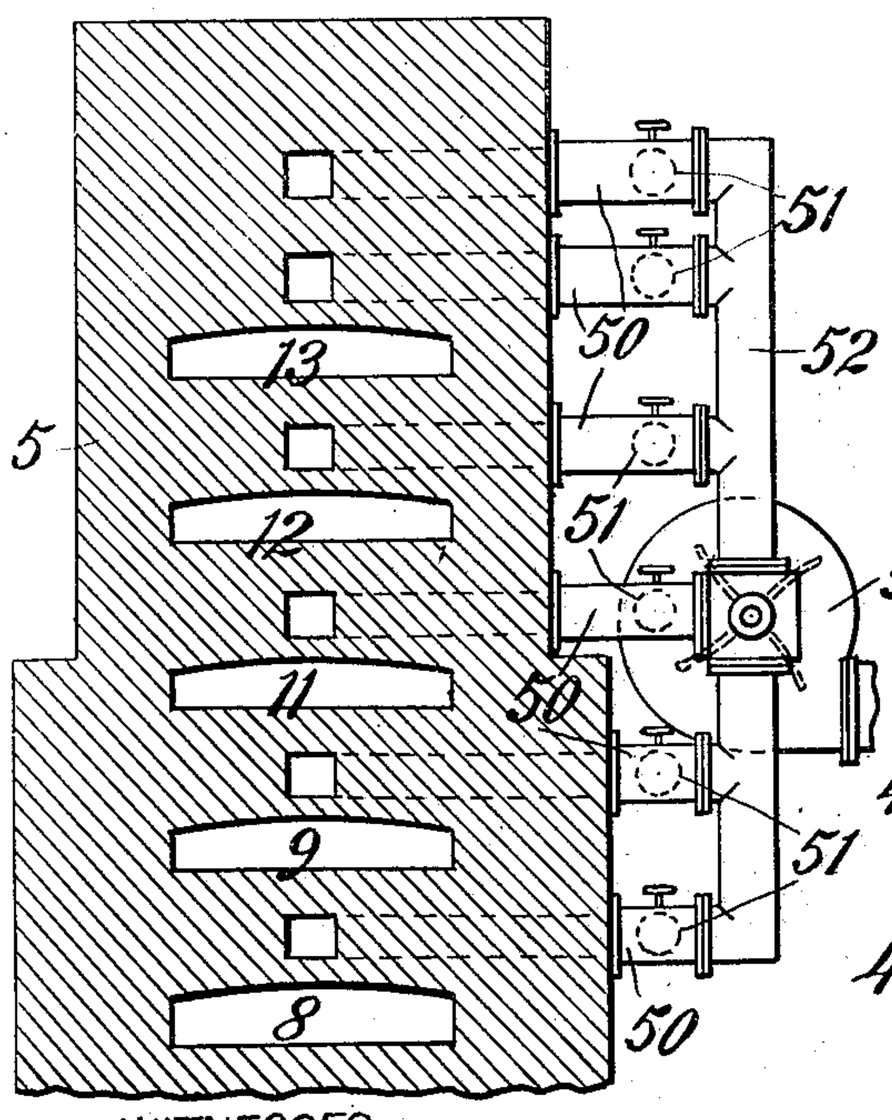
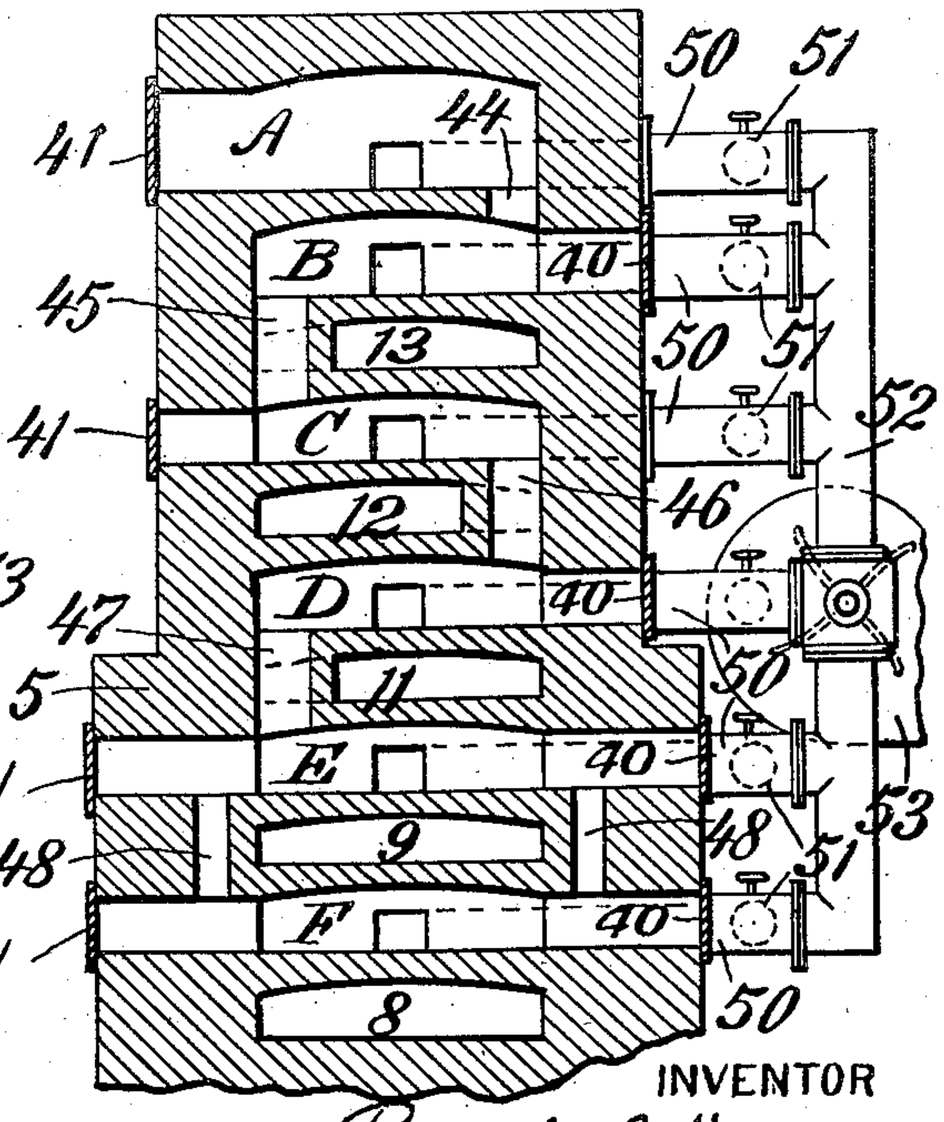


FIG. 3.



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2 SHEETS—SHEET 2.

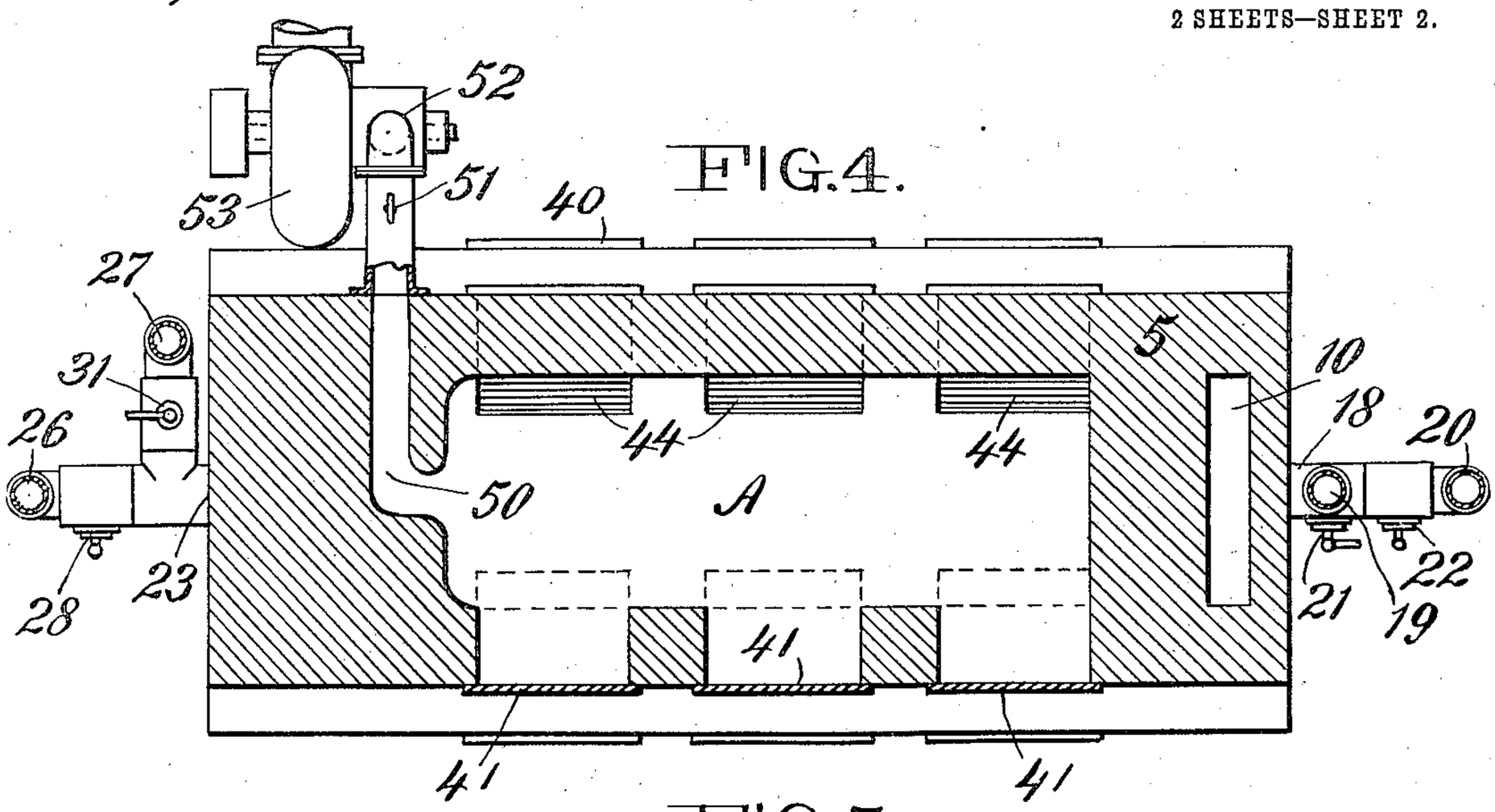

FIG. 4.

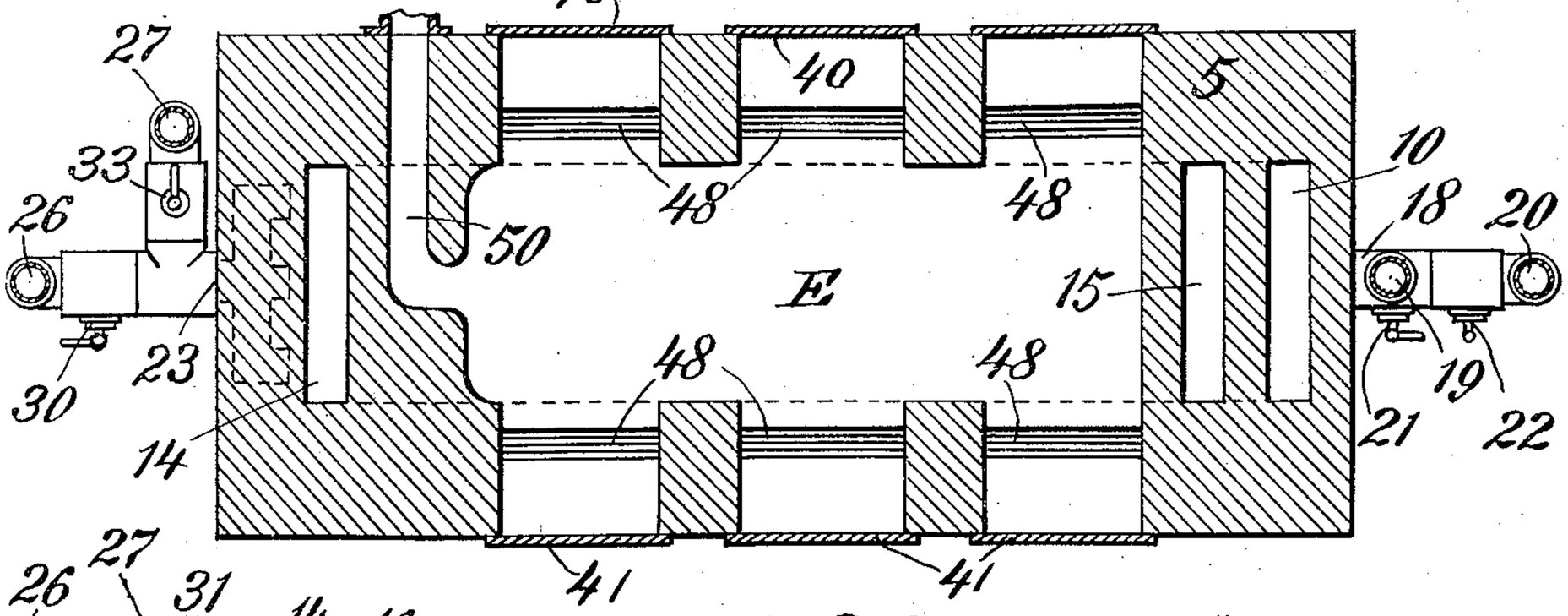

FIG. 5.

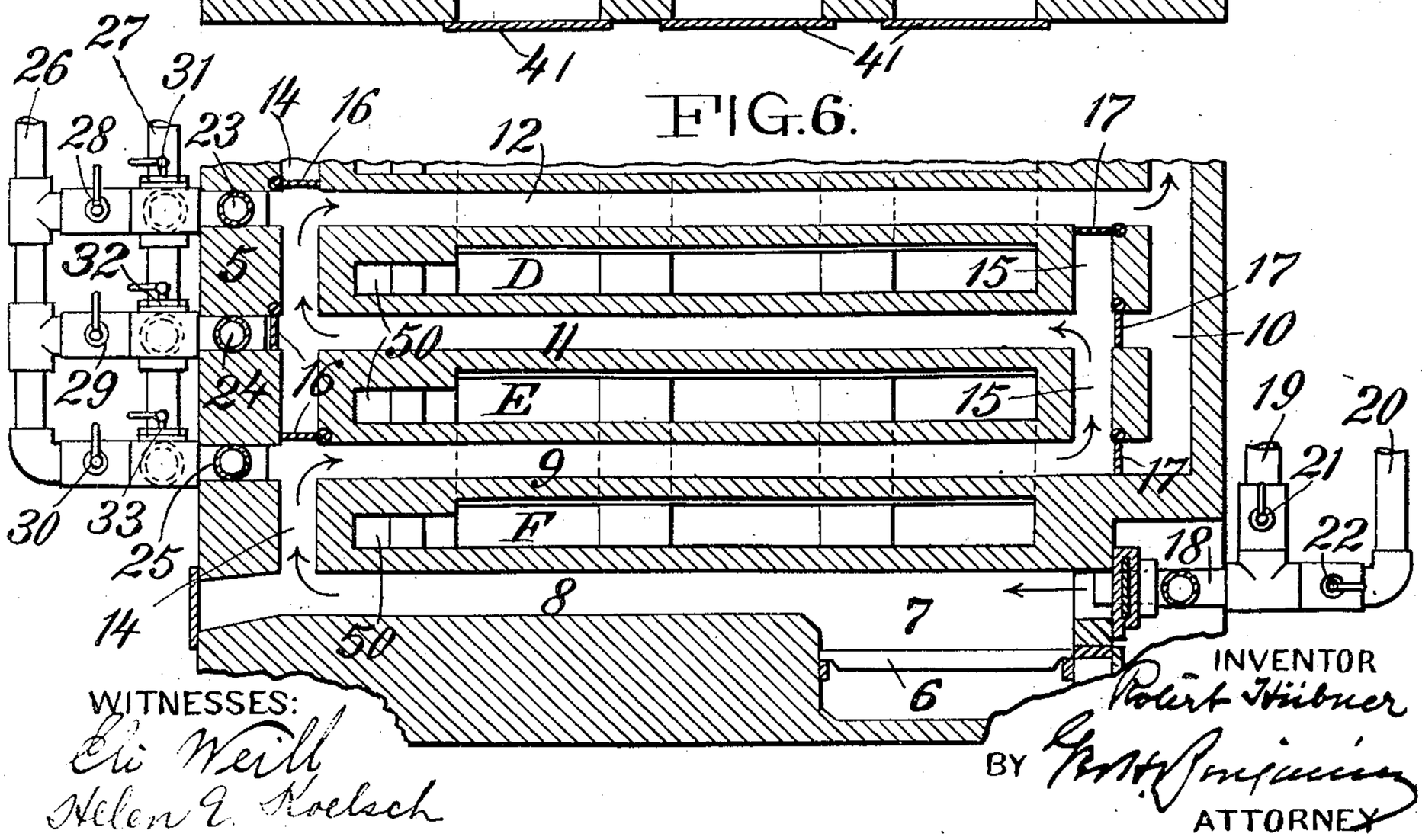

FIG. 6.

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METALLURGICAL FURNACE.

934,532. Specification of Letters Patent. Patented Sept. 21, 1909.

Application filed June 8, 1909. Serial No. 500,935.

To all whom it may concern:

Be it known that I, ROBERT HÜBNER, a citizen of the United States, residing at New York city, county and State of New York, have invented certain new and useful Improvements in Metallurgical Furnaces, of which the following is a specification.

My invention more especially relates to a furnace designed to effect desulfurization of ores, although it may be used for other purposes.

In United States Patents Nos. 899,403, dated September 22nd, 1908, and 906,883, dated December 15th, 1908, I have respectively described a furnace for desulfurizing ores and a process of desulfurizing ores. My improved furnace is an improvement upon the construction disclosed in my Patent 899,403 and is intended to carry into effect the process described in my Patent 906,883.

The features of novelty of my present furnace over that described in my Patent 899,403 consist, in the provision of means for heating the furnace by the combination of gas and air under pressure, in the provision of means for localizing the heat at different portions of the furnace structure, in the provision of means for altering the direction of flow of the products of combustion in the furnace, and generally, in the construction and arrangement of the flues, air passages, etc.

The accompanying drawings will serve to illustrate my invention, in which—

Figure 1 is a vertical longitudinal section; Fig. 2 is a vertical transverse section on the line II—II of Fig. 1. Fig. 3 is a vertical transverse section on the line III—III of Fig. 1. Fig. 4 is a longitudinal section on the line IV—IV of Fig. 1. Fig. 5 is a longitudinal section on the line V—V of Fig. 1. Fig. 6 is a vertical longitudinal section, showing a modification of Fig. 1.

Referring to the drawings: 5 represents the furnace structure, and as in the furnace described in my Patent No. 899,403, is provided with a grate 6 and a combustion chamber 7. The combustion chamber 7 communicates through the horizontal flues 8, 9, directly with the vertical chimney flue 10, and indirectly through the horizontal flues 11, 12, 13, vertical flues 14, 15, and controlling dampers 16, 17. It will be understood without further description that by manipulation of the dampers 16, 17, all of the flues 8, 9, 11, 12, 13 may be thrown into communication with the chimney flue 10, or 9, 11, 12, 13, separately.

18 represents a gas burner adapted to discharge gas and air under pressure into the furnace chamber 7.

19 represents gas pipe, 20 air pipe, 21—22 controlling valves respectively in the gas and air pipes. I prefer to use gas and air under pressure, respectively in the proportions of one part of gas to one quarter part of air, as this mixture results in a flame of very high temperature. Situated at the opposite side of the furnace, or any convenient locality, are similar burners 23, 24, 25, adapted to discharge gas and air respectively into the flues 12, 11, 9.

26 represents gas pipe, 27 air pipe, 28—29—30 valves in the gas pipe and 31—32—33 valves in the air pipe. The burners 23, 24, 25 are preferably situated at the opposite side of the furnace from the burner 18, although they may be placed in any convenient locality.

It will be understood that the burners 18, 23, 24, 25 may be used in combination or singly, as desired.

Situated between the flues 8, 9, 11, 12 are the ore chambers F, E, D, C, and above the flue 13, the ore chambers A, B. These chambers communicate with the exterior of the furnace through openings closed by doors 40, on the right and 41 on the left of the furnace structure. The doors may be arranged on one side of the furnace or on two sides, as desired. The chambers A, B, C, D, E, F, communicate with each other through openings in the horizontal walls 44, 45, 46, 47, 48. Connected to each of these chambers is a pipe 50, in which is a valve 51. These pipes are all connected to a common pipe 52, connected at its end to the induction orifice of a vacuum pump 53.

The method employed for operating the furnace is as follows: The ore to be desulfurized is introduced into the chamber A at the top of the furnace. This chamber, it will be observed, is not in direct communication with any of the heat flues of the furnace, but is separated therefrom by the chamber B. This chamber is also somewhat larger than the other chambers, the purpose of which is to permit evaporation of the moisture of the ore, by slow heating, which moisture is drawn off by one of the pipes

50 through the pump 53. After a time (depending upon the character of the ore) the partially roasted ore is pushed through the opening 44 into the chamber B. Here it is subjected to a higher temperature, the evolved gases being drawn off as in the chamber A. After a time the ore is pushed through the opening 45 into the chamber C, and so on progressively downward through chambers D, E and F, from which it is drawn from the furnace. It will be understood that doors 40, 41, 42, 43, during the operation of the furnace, are luted to prevent the ingress of air, and that the action of the pump 53 is to produce a vacuum or partial vacuum in the ore chambers. It will be understood without further description that the vacuum or partial vacuum so produced, prevents the accumulation of the evolved gases in the ore chambers and prevents their pressure from effecting the rapid evolution of the gases from the ore treated.

To effect desulfurization of the ore it is usually not necessary to carry the ore beyond the chamber E, or in other words, by the time the ore reaches the chamber E, desulfurization has been effected. The desulfurization of the ore may be facilitated by increasing the temperature of the furnace normally due to combustion at burner 18, to combined effect of the combustion at burner 18 and fire on grate 6, through the burners 23, 24, 25. For certain grades of ore it is considered advisable to commence the heating slowly and gradually increase the heat as the ore is progressed downward through the furnace structure. With other ores it is advisable to commence the heating slowly, then subject to a high heat, then to a lower heat and then to a high heat. With still other grades of ore it is advisable to concentrate the heat at about the center of the furnace. The various heating effects, as before stated, may be accomplished through the conjoint employment of the various burners, heating flues and dampers. The exact direction of the flow of the products of combustion will of course depend upon circumstances, which will be evident to any one skilled in furnace management, and having a knowledge of the ore to be treated.

I wish it understood that I do not limit myself to the specific construction of the furnace shown and described, as it will be obvious that it may be modified in many particulars without departing from the general features of the invention disclosed.

Having thus described my invention, I claim:—

1. A metallurgical furnace, comprising a series of heating flues, a series of ore chambers, a chimney flue, a series of gas and air burners communicating with said heating flues, means for controlling the direction of flow of the products of combustion through said furnace and means for controlling the application of heat to said furnace.

2. A metallurgical furnace, comprising a series of heating flues, a series of ore chambers, a chimney flue, a series of gas and air burners communicating with said heating flues, means for controlling the direction of flow of the products of combustion through said furnace, and means for controlling the application of heat to different portions of said furnace.

3. A metallurgical furnace, comprising a series of heating flues, a series of ore chambers, alternately disposed, a chimney flue, a series of gas and air burners communicating with said heating flues, means for controlling the direction of flow of the products of combustion through said furnace, and means for controlling the application of heat to different portions of said furnace.

4. A metallurgical furnace, comprising a series of heating flues, a series of ore chambers closed against the atmosphere, a chimney flue, a series of gas and air burners communicating with said heating flues, an exhaust pump connected to the ore chambers, means for controlling the direction of flow of the products of combustion through said furnace, and means for controlling the application of heat to said furnace.

5. A metallurgical furnace, comprising a series of heating flues, a series of communicating closed ore chambers, a chimney flue, a series of gas and air burners communicating with said heating flues, means for controlling the direction of flow of the products of combustion through said furnace, and means for controlling the application of heat to said furnace.

6. A metallurgical furnace, comprising a series of heating flues, a series of ore chambers closed against the atmosphere and alternately disposed, a chimney flue, a series of gas and air burners communicating with said heating flues, means for controlling the direction of flow of the products of combustion through said furnace, and means for controlling the application of heat to different portions of said furnace.

7. A metallurgical furnace, comprising a series of heating flues, a series of ore chambers closed against the atmosphere, a chimney flue, a series of gas and air burners communicating with said heating flues, and adapted to deliver gas and air under pressure, means for controlling the direction of flow of the products of combustion through said furnace, and means for controlling the application of heat to different portions of said furnace.

8. A metallurgical furnace, comprising a series of heating flues, a series of ore chambers, a chimney flue, a series of gas and air burners communicating with said heating

flues, dampers for controlling the direction of flow of the products of combustion through said furnace flues, and means for controlling the application of heat to different portions of said furnace.

9. A metallurgical furnace, comprising a series of heating flues, a series of ore chambers, a chimney flue, a series of gas and air burners communicating with the heating flues, dampers for controlling the direction of flow of the products of combustion through said furnace flues, and gas and air valves for controlling the application of heat to different portions of said furnace.

10. A metallurgical furnace, comprising a series of heating flues, a series of ore chambers, a chimney flue, a combustion chamber and grate, a series of gas and air burners, means for controlling the direction of flow of the products of combustion through said furnace, and means for controlling the application of heat to different portions of said furnace.

11. A metallurgical furnace, comprising a series of horizontal heating flues, vertical communicating flues, a series of horizontal ore chambers, a chimney flue, a series of gas and air burners adapted to project a flame into the horizontal flues, means interposed between the horizontal and vertical flues for controlling the direction of flow of the products of combustion through said furnace, and means for controlling the application of heat to different portions of said furnace.

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

ROBERT HÜBNER.

Witnesses:
HELEN E. KOELSCH,
W. A. TOWNER, Jr.