(No Model.) 2 Sheets—Sheet 1.

J. H. WELCH.

FURNACE PLANT.

No. 486,310. Patented Nov. 15, 1892.

Fig: 1.

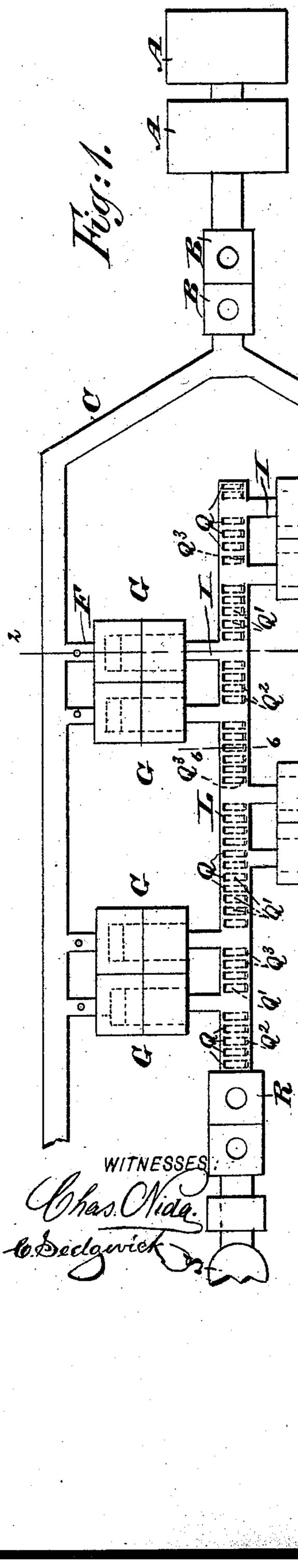

Fig: 5

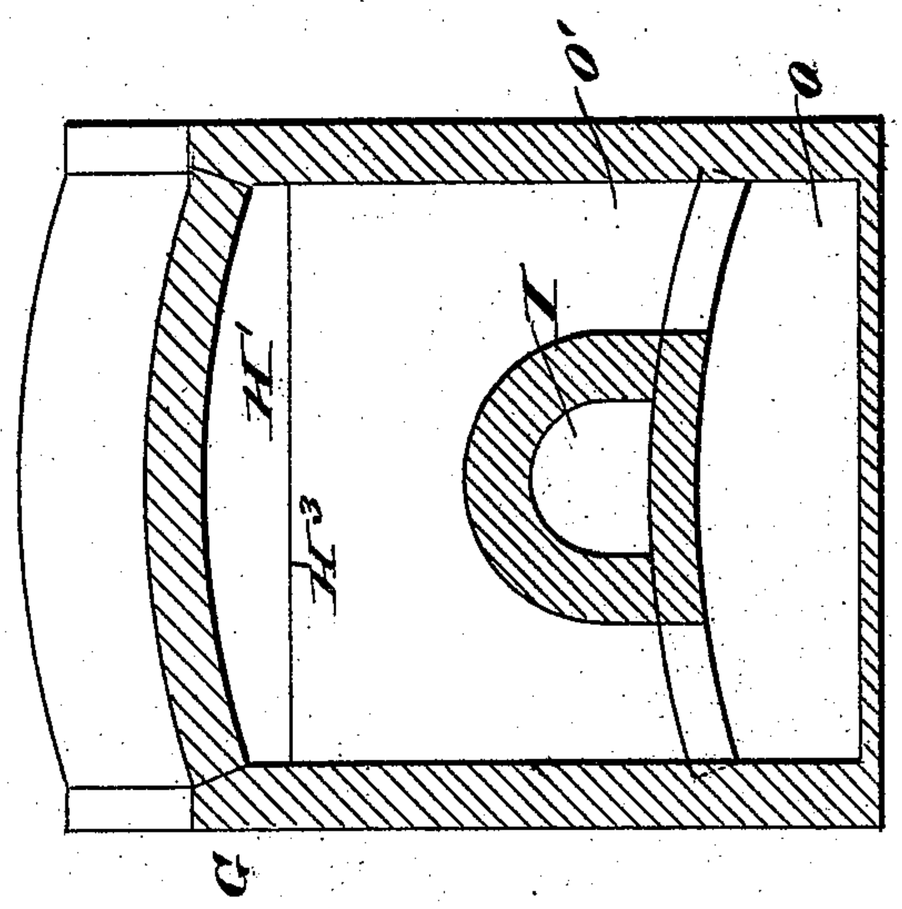

Fig: 4.

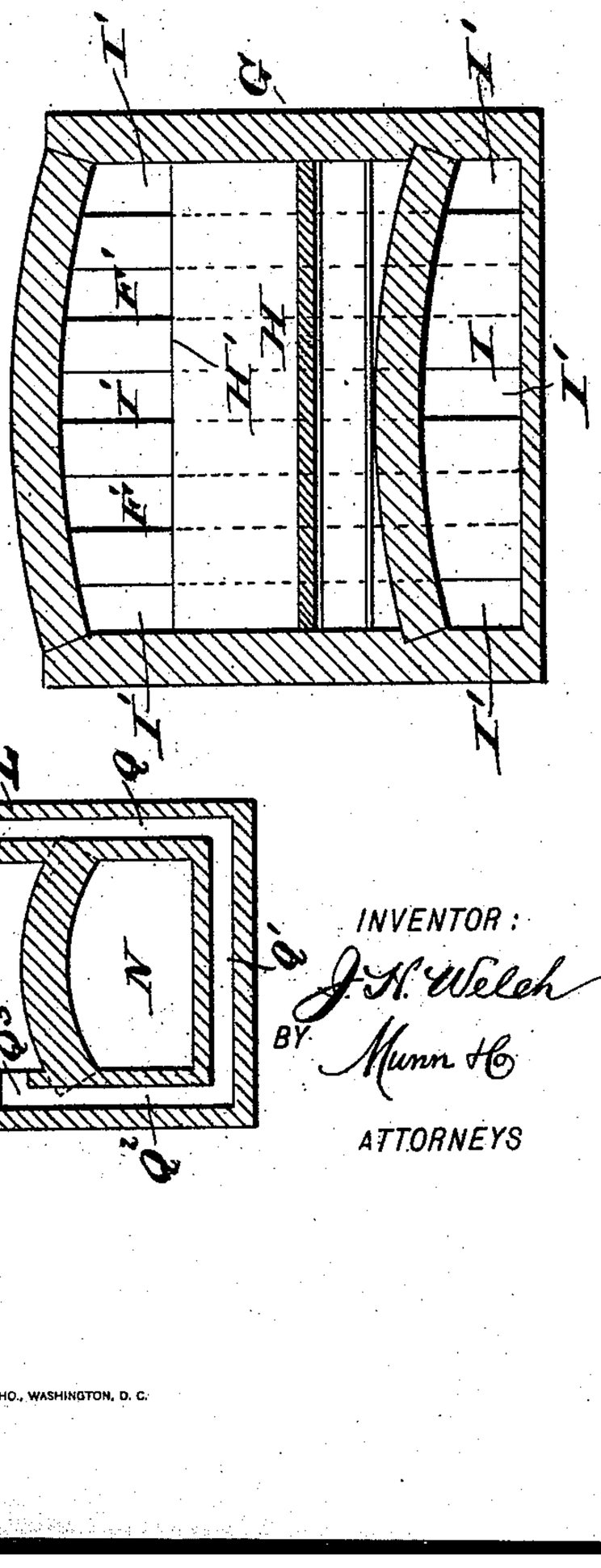

Fig: 6.

WITNESSES:

Chas. Nida.

C. Sedgwick

INVENTOR:

J. H. Welch

BY Munn & Co

ATTORNEYS

(No Model.) 2 Sheets—Sheet 2.

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Fig: 2.

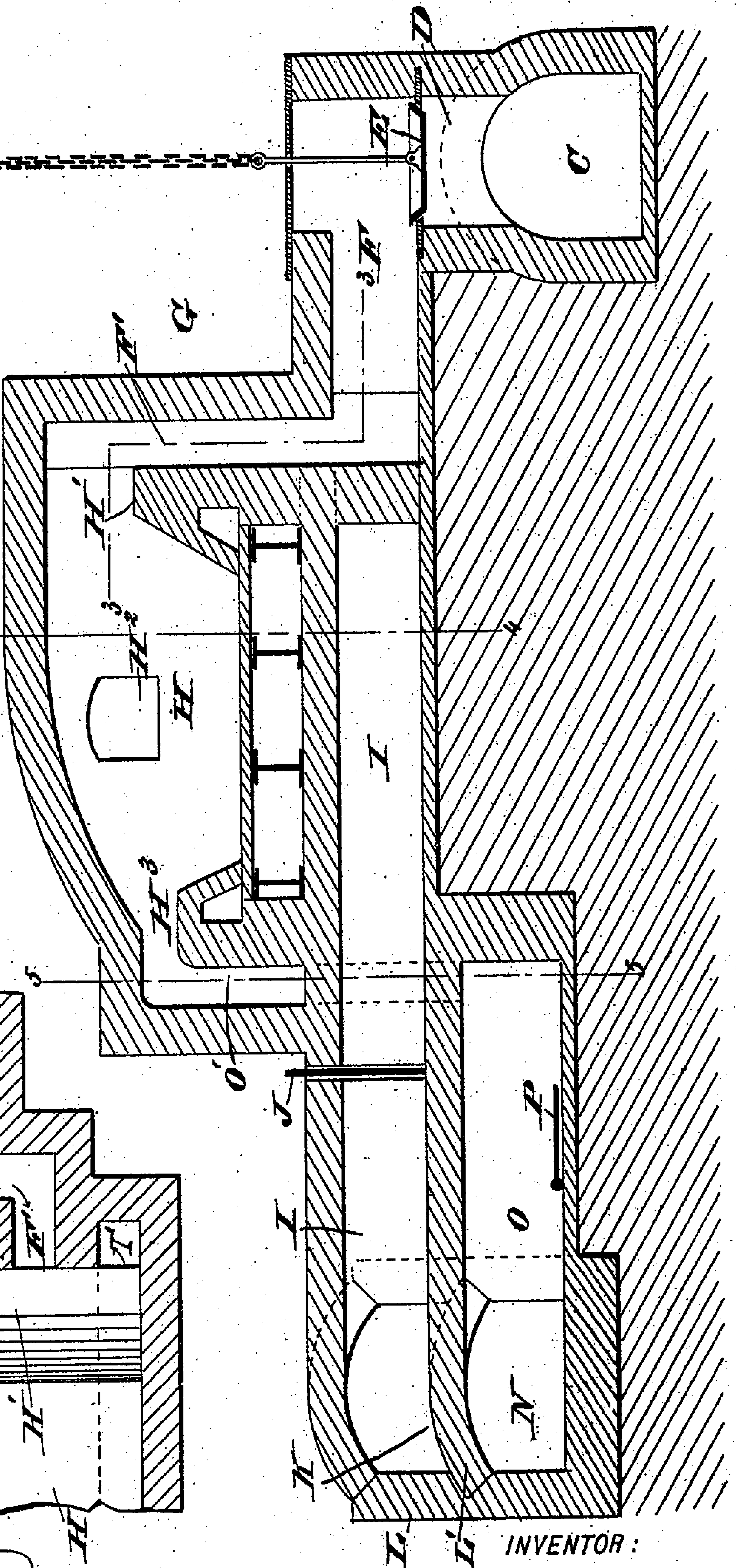
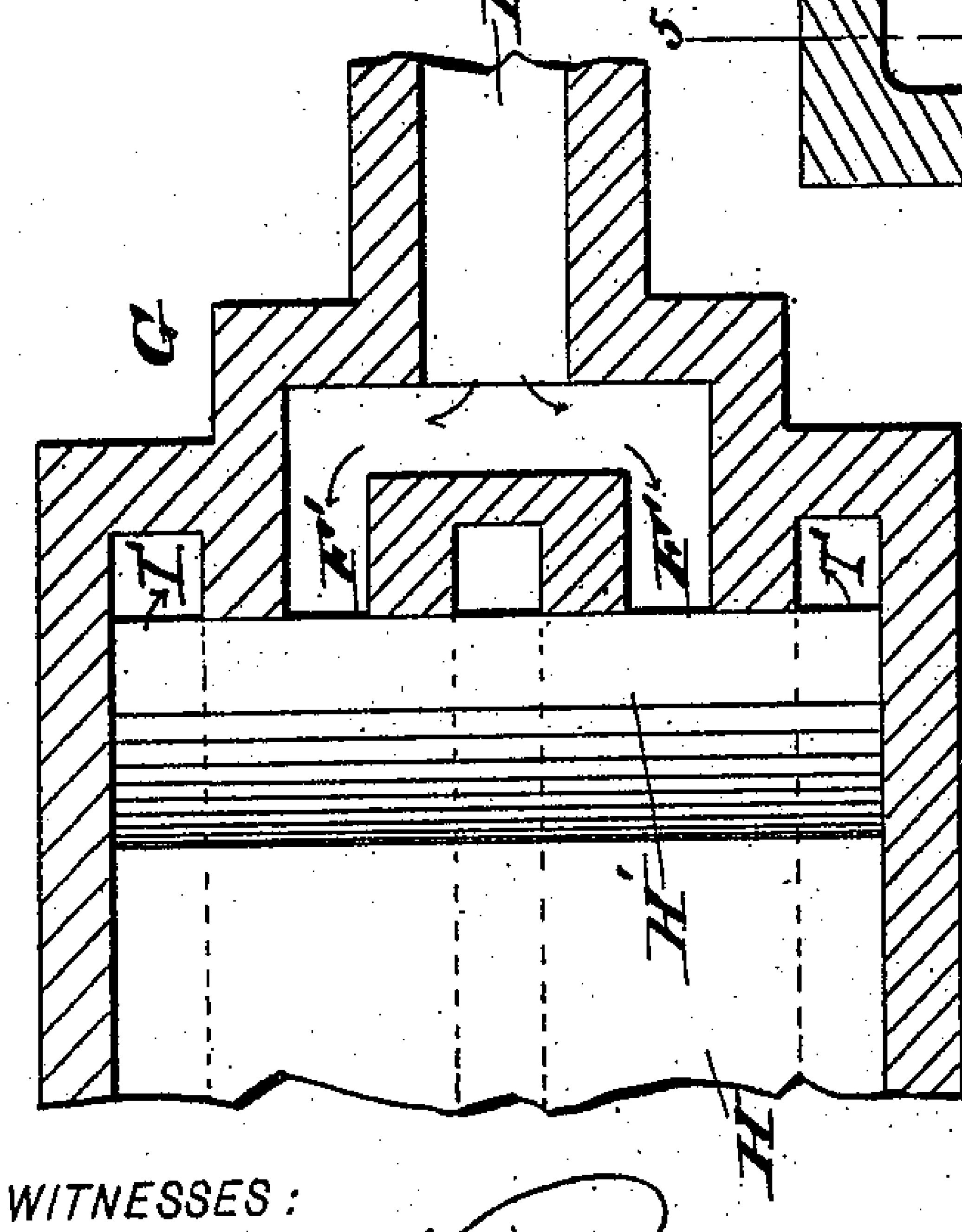


Fig: 3.



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INVENTOR:

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BY Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

JAMES H. WELCH, OF PITTSBURG, PENNSYLVANIA.

FURNACE PLANT.

SPECIFICATION forming part of Letters Patent No. 486,310, dated November 15, 1892.

Application filed January 14, 1892. Serial No. 418,092. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. WELCH, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and Improved Furnace Plant, of which the following is a full, clear, and exact description.

The invention relates to puddling and other furnaces heated by gas, but not using the regenerative system.

The object of the invention is to provide a new and improved furnace plant in which the waste heat of each individual furnace is utilized for the purpose of heating the air necessary for combustion of the gases, effecting a great saving in the use of the gas and at the same time consuming all smoke and doing away with the necessity of building a stack for each individual furnace.

The invention consists of a conduit connected with a single chimney and formed with a horizontal partition dividing the flue into two flues, located one above the other, the lower one conducting the waste gases from the furnace to the chimney and the other affording a supply of fresh-heated air for the several furnaces.

The invention also consists of certain parts and details and combinations of the same, as will be fully described hereinafter, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a plan view of the improvement. Fig. 2 is an enlarged sectional side elevation of one of the furnaces on the line 2 2 of Fig. 1. Fig. 3 is a sectional plan view of part of the same on the line 3 3 of Fig. 2. Fig. 4 is a transverse section of the same on the line 4 4 of Fig. 2. Fig. 5 is a similar view of the same on the line 5 5 of Fig. 2, and Fig. 6 is an enlarged transverse section of the main conduit on the line 6 6 of Fig. 1.

The improved furnace plant is provided with suitable gas-producers A, connected with one or more apparatus B, of any approved construction, and serving to clean and enrich the gas before the latter passes to one or more flues C, leading the gas to the various furnaces, as hereinafter more fully described. Each flue C is provided near each furnace with a branch flue D, extending upward and adapted to be connected by a valve E with a gas-flue F, forming part of the individual furnace G. From each gas-flue F extend upward at one end of the furnace G one or more flues F′, opening at their upper ends upon the hearth H over the wall H′, as is plainly shown in Fig. 2. The hearth H is of any approved construction, provided with the usual inlet-openings H^2 and also formed opposite the wall H′ with a wall H^3, over which passes the waste gas to be led from the hearth H. Alongside the flues F′ are arranged the flues I′, separated from the said flues F′ by suitable walls, the said flues I′ opening into the hearth H at the wall H′, so as to readily mix with the incoming gases to permit the latter to burn in the hearth H, complete combustion being obtained by the incoming air through the flues I′. The lower ends of the latter connect with a duct I, extending under the hearth H and containing outside the latter a valve J for regulating the amount of air passing to the hearth to be burned in conjunction with the gases passing up the flues F′. The outer end of each duct I leads into a flue K, forming part of a main conduit L, built with an arch L′, dividing the conduit into the said flue K and into a second flue N, extending below the flue K. From the flue N leads a branch duct O to each individual furnace, the end of the said duct being connected by a channel O′ with the hearth H at the wall H^3, so that the waste gas can pass from the hearth over the said wall H^3 into the channel O′ and into the duct O, to pass finally into the flue N of the main conduit L.

It will be seen by reference to Figs. 2 and 5 that the duct O extends under part of the duct I, and the latter also passes through the channel O′, so that the waste gases from the hearth heat the said duct I in the channel O′ and also that part of the duct I extending under the duct O. The waste gases in passing along the flue N, located under the flue K, again heat the air traveling along the said flue K, so that the waste gases are utilized to heat the incoming air used for combustion of the gases.

The main conduit L, as is plainly shown in Fig. 6, is formed in one side wall with flues Q, the upper end of each of which is con-

nected with the outer atmosphere, and the lower end terminates in a horizontal flue Q′, extending under the bottom of the flue N, and then connects with the vertical flue Q^2, arranged in the outer wall, and then from this flue lead ports Q^3 into the flue K, so that the incoming air, passing through the flues Q, Q′, and Q^2, is heated by the outgoing waste gases, and thus receives a preheating before entering the flue K, in which latter the waste gases again heat the air before it is drawn into the duct I to be burned on the individual hearth H of each furnace. The end of the conduit L is connected with an apparatus R for enriching the waste gases which have been cooled, the apparatus being of any approved construction and leading the enriched gases to boilers S for generating steam or for other purposes, to be burned therein, and to finally connect with a chimney which furnishes the necessary draft for the various furnaces G and the boilers S. It will be seen that almost every unit of heat contained in the waste gases is utilized to heat the incoming air necessary for the combustion of the gases in each individual hearth. The waste gases thus become cooled before finally entering the enriching apparatus R to permit of being re-enriched and utilized for furnishing the necessary fuel for the boilers generating steam necessary for running the rolling-mill.

In each flue O is arranged a valve P, controlled from the outside and serving to regulate the outflow of the waste gases from the hearth H to the flue N of the main conduit L. Thus by the use of this valve P the burning of the fuel—that is, the gas and air—in the hearth H can be regulated to any desired degree. It will be seen that by this arrangement one single chimney furnishes the necessary draft for the various furnaces, enriching devices, boilers, &c., arranged in the plant, as shown and described. It will further be seen that by this arrangement the waste gases from the furnace serve to heat the incoming air necessary for combustion, whereby the waste gases are brought to a state which permits of enriching the gases as described. It is also understood that in the enriching apparatus R sufficient carbon is injected or inserted to convert the carbon dioxide into carbon monoxide, thus producing a gas which undergoes a second combustion, generating steam, or using it for other purposes.

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

1. A furnace plant comprising a series of hearth-furnaces connected with a general gas-supply, an air-duct for each of the said hearth-furnaces and leading to the combustion-chamber of the hearth to supply the air necessary for the combustion of the gas, and a waste-gas duct for each hearth-furnace and extending under part of the corresponding air-duct and formed with a channel through which passes the said air-duct and which channel opens into the respective hearth at the discharge side thereof, substantially as shown and described.

2. A furnace plant comprising a series of hearth-furnaces connected with a general gas-supply, an air-duct for each of the said hearth-furnaces and leading to the combustion-chamber of the hearth to supply the air necessary for the combustion of the gas, a waste-gas duct for each hearth-furnace and extending under part of the corresponding air-duct and formed with a channel through which passes the air-duct and which channel opens into the respective hearth at the discharge side thereof, and a main conduit for the several hearth-furnaces and formed with an air-flue connected with the outer air and with each of the said air-ducts and also formed with a waste-gas flue extending under the said air-flue and into which lead the several waste-gas ducts, substantially as shown and described.

3. In a furnace plant, the combination, with a series of hearth-furnaces connected with a general gas-supply, of a main conduit formed with an arch to divide the conduit into two flues, of which one is the waste-gas flue and the other the air-supply flue, the said waste-gas flue extending under the air-supply flue and connected with a chimney and with waste-gas channels from the said hearth-furnaces, the said air-supply flue being connected with the several hearth-furnaces to supply the air necessary for the combustion of the gas, substantially as shown and described.

4. In a furnace plant, the combination, with a series of hearth-furnaces connected with a general gas-supply, of a main conduit formed with an arch to divide the conduit into two flues, of which one is the waste-gas flue and the other the air-supply flue, the said waste-gas flue extending under the air-supply flue and connected with a chimney and with waste-gas channels from the said hearth-furnaces, the said air-supply flue being connected with the several hearth-furnaces to supply the air necessary for the combustion of the gas, and air-inlet channels arranged in the sides and bottom of the said conduit and leading to the air-supply flue, substantially as shown and described.

5. In a furnace plant, the combination, with a series of furnaces connected with a general gas-supply, of a main conduit having an air-supply flue and a waste-gas flue, both connected with the series of furnaces, air-inlet channels arranged in the sides and bottom of the conduit and leading to the air-supply flue, and a chimney or stack connected with the waste-gas flue to furnish draft for the entire series of furnaces, substantially as shown and described.

6. A furnace plant comprising a series of hearth-furnaces connected with a gas-supply, an air-duct for each of the said hearth-furnaces and leading to the combustion-chamber of the hearth to supply the air necessary for

the combustion of the gas, a waste-gas duct for each hearth-furnace and extending under part of the corresponding air-duct and formed with a channel through which passes the air-duct, each channel opening into the hearth at the discharge side thereof, and a main conduit for the several hearth-furnaces and provided with an air-flue connected with the outer air and with each of the said air-ducts, a waste-gas flue extending under the said air-flue and into which lead the several waste-gas ducts, and a valve arranged in each of the said waste-gas ducts to control the heat within each of the hearths, substantially as shown and described.

7. A furnace plant comprising a series of hearth-furnaces connected with a gas-supply, an air-duct for each of the said hearth-furnaces and leading to the combustion-chamber of the hearth to supply the air necessary for the combustion of the gas, a waste-gas duct for each hearth-furnace and extending under part of the corresponding air-duct and formed with a channel through which passes the air-duct, each channel opening into the hearth at the discharge side thereof, and a main conduit for the several hearth-furnaces and provided with an air-flue connected with the outer air and with each of the said air-ducts, a waste-gas flue extending under the said air-flue and into which lead the several waste-gas ducts, and a valve or gate arranged in each of the said air-ducts for controlling the supply of air to each hearth, substantially as shown and described.

8. In a furnace plant, the combination, with a series of furnaces, of a main conduit having an air-supply flue and a waste-gas flue, both connected with a series of furnaces, air-inlet channels arranged in the sides and bottom of the said conduit and leading to the air-supply flue, a chimney or stack connected with the waste-gas flue to furnish draft for the entire series of furnaces, and an enriching apparatus arranged in the said main conduit between the chimney and the furnace next to it, substantially as shown and described.

JAMES H. WELCH.

Witnesses:
J. H. CUNNINGHAM,
J. H. GLONINGER.