(No Model.) 3 Sheets—Sheet 1.

J. R. MOFFITT.

RETORT AND CRUCIBLE FURNACE.

No. 327,709. Patented Oct. 6, 1885.

Fig. 3.

Fig. 2.

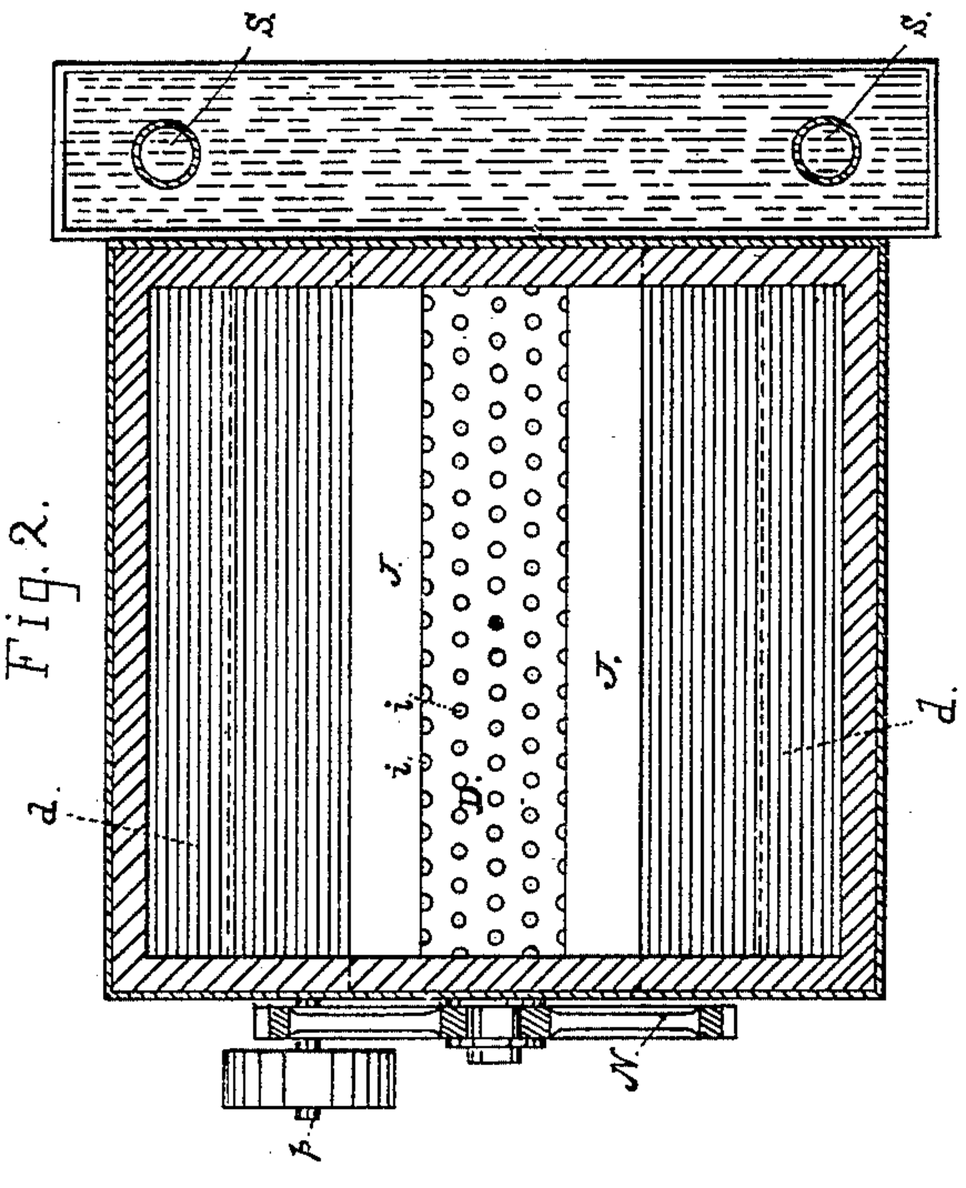
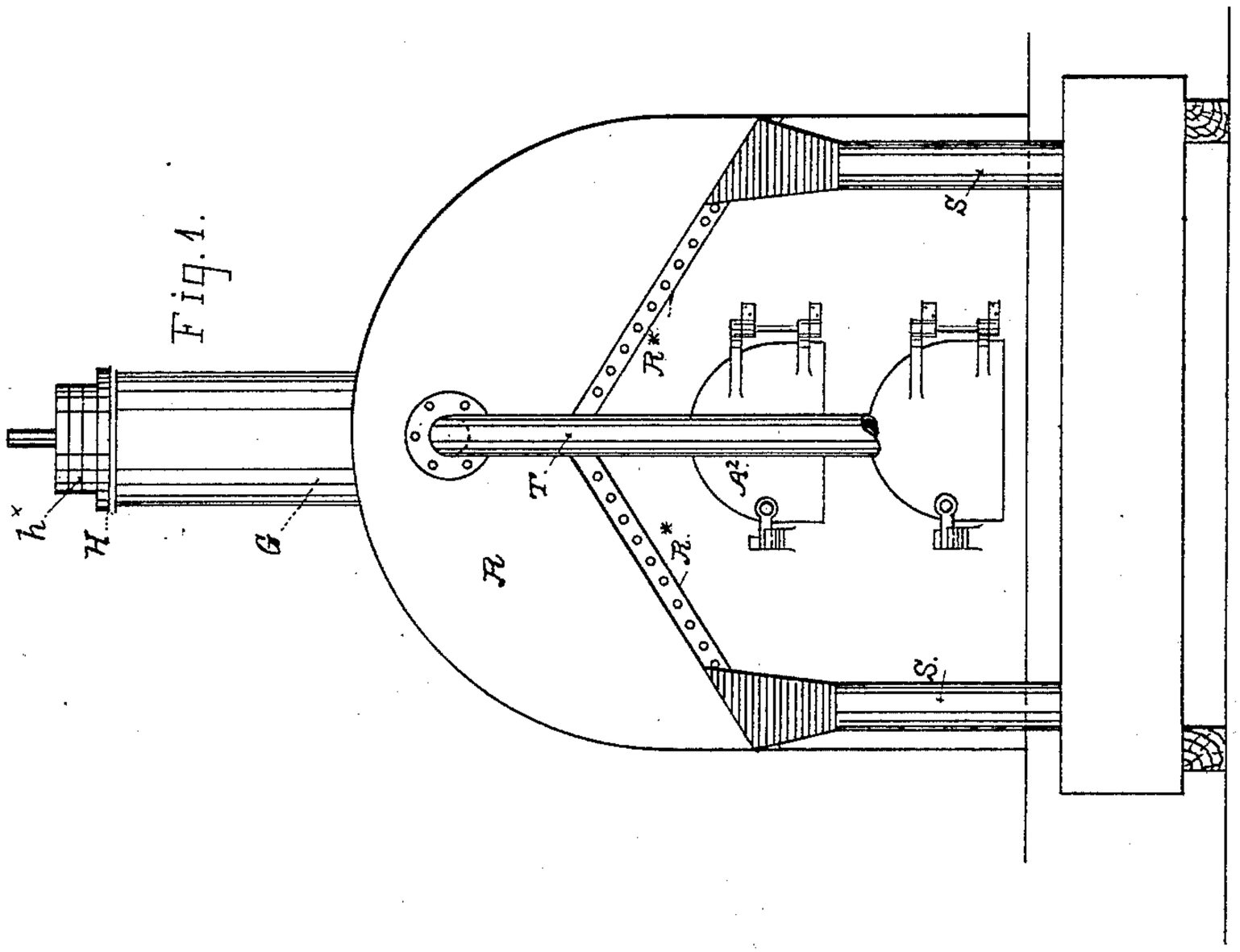


Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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RETORT AND CRUCIBLE FURNACE.

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Fig. 5.

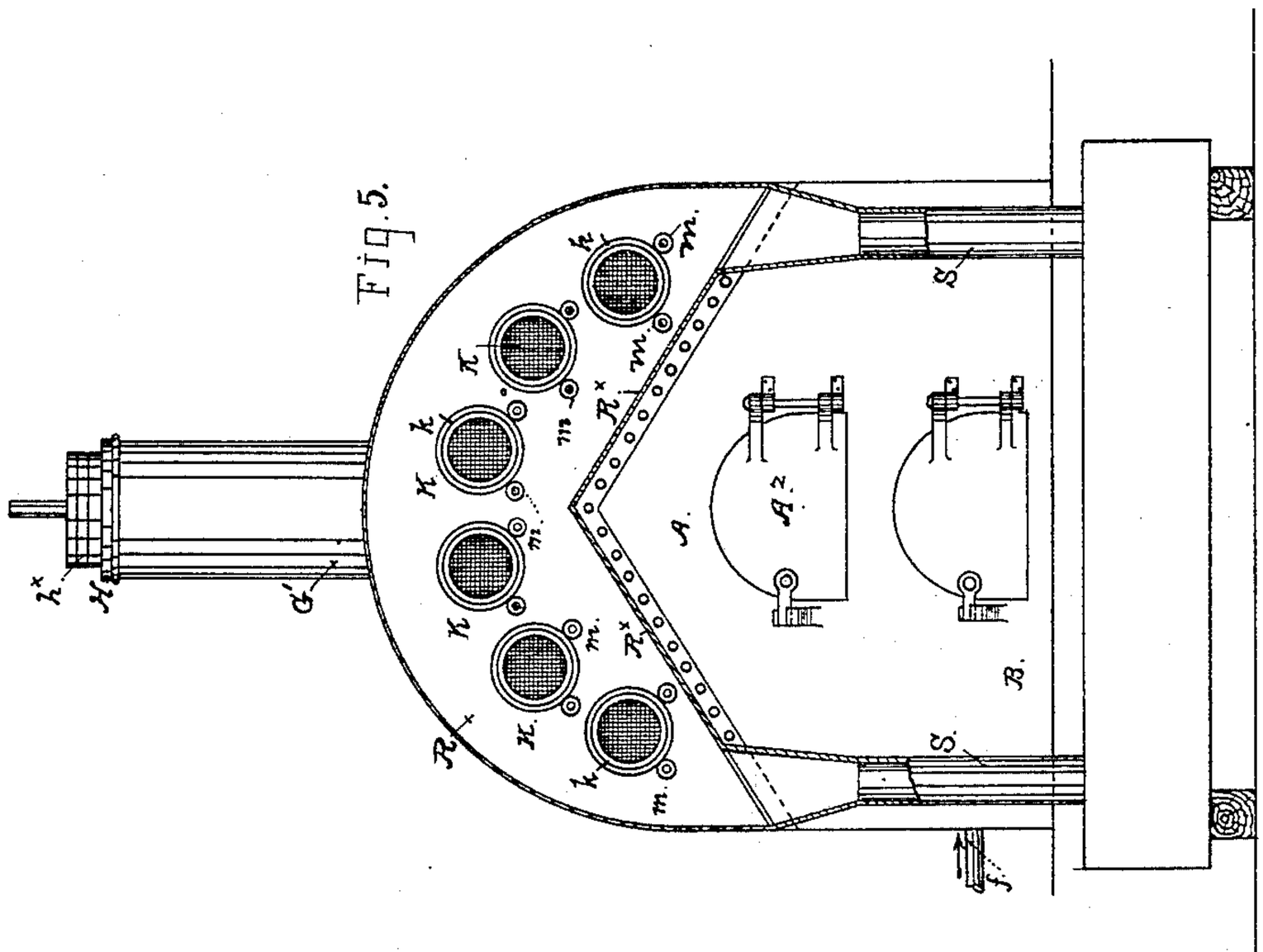
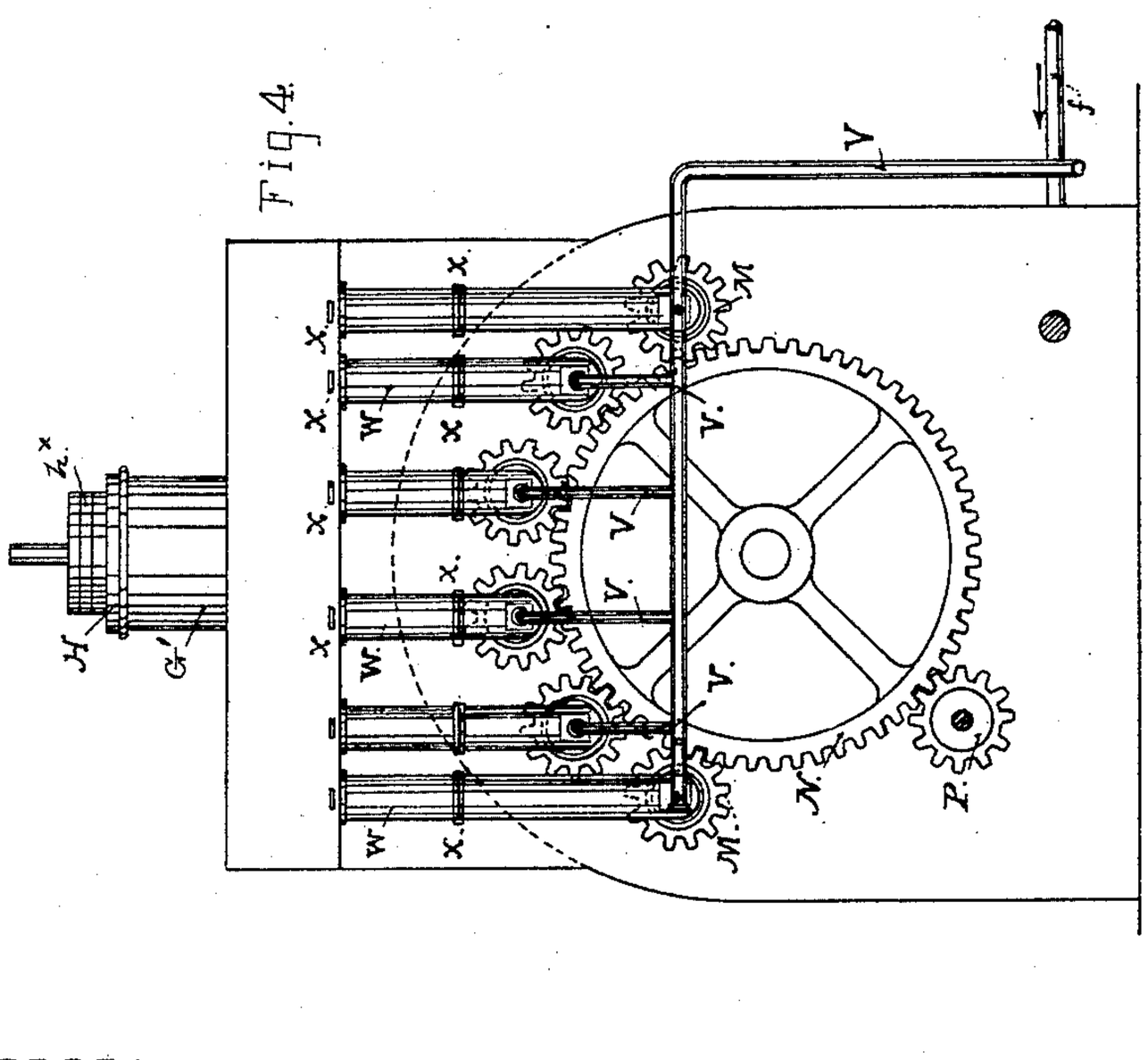


Fig. 4.



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(No Model.)

3 Sheets—Sheet 3.

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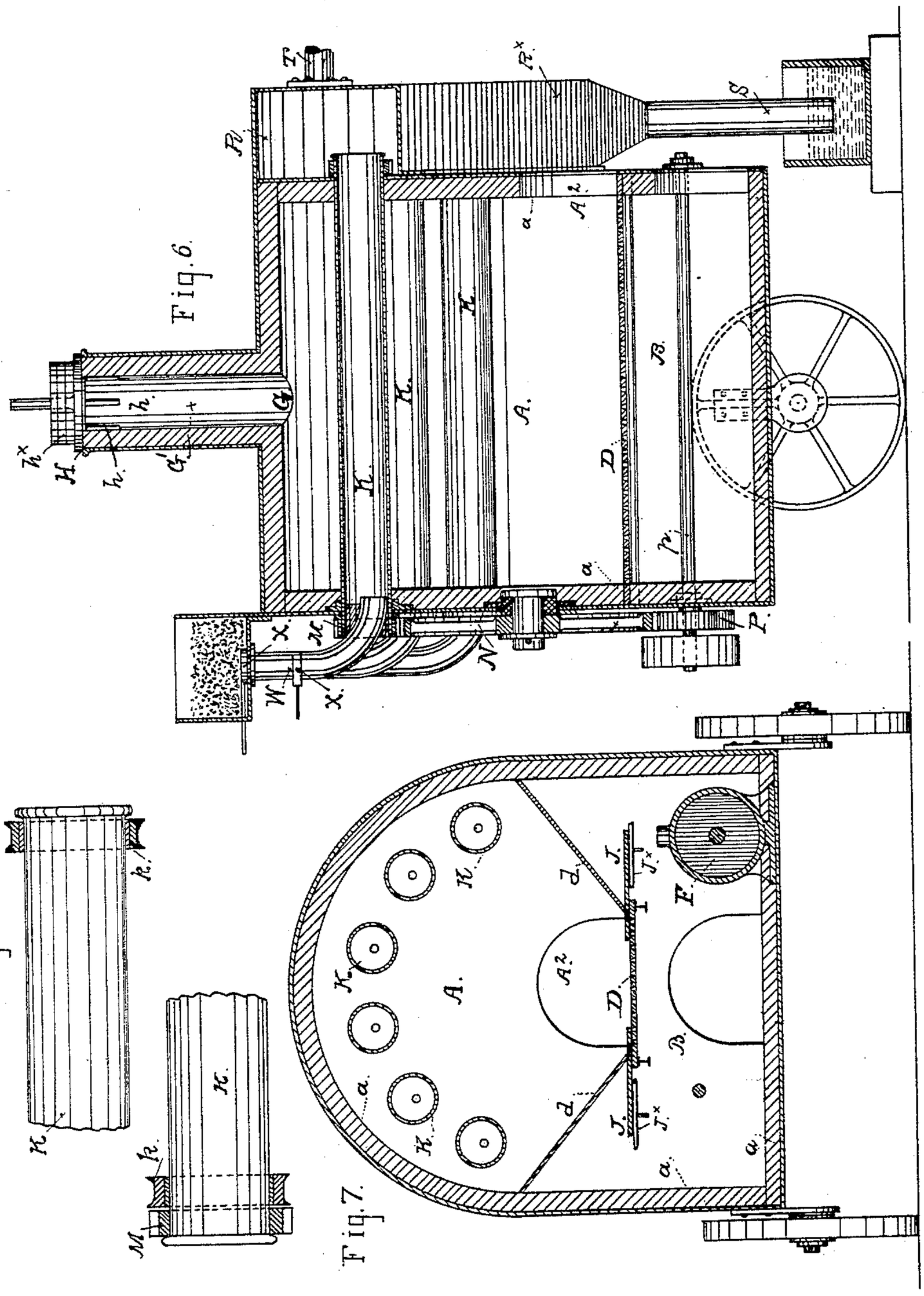
RETORT AND CRUCIBLE FURNACE.

No. 327,709. Patented Oct. 6, 1885.



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UNITED STATES PATENT OFFICE.

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RETORT AND CRUCIBLE FURNACE.

SPECIFICATION forming part of Letters Patent No. 327,709, dated October 6, 1885.

Application filed April 11, 1885. Serial No. 161,879. (No model.)

To all whom it may concern:

Be it known that I, JOHN R. MOFFITT, a citizen of the United States, residing at Chinese Camp, in the county of Tuolumne and State of California, have invented an Improved Retort and Crucible Furnace for Treating Ores and Metals; and I do hereby declare that the following is a full, clear, and exact description of my said invention, reference being had to the drawings that accompany and form a part of this specification.

My improved furnace is applicable to all the processes and operations by which gold, silver, and other metals are separated from their ores and from various impurities, and by which also such metals as lead and quicksilver are obtained. It is therefore adapted for roasting, reducing, desulphurizing, and smelting operations, and it is also suitable as a retort-furnace where the product to be obtained is a gas.

My invention consists in a certain novel construction and combination of parts in respect of each of these features, as hereinafter fully described.

Referring to said drawings, wherein an improved furnace both of the portable and stationary kind is represented, Figure 1 is a front elevation of a stationary furnace constructed in accordance with my invention. Fig. 2 is a plan of the grate-surface with the walls of the furnace in section at a line just above the top of the inclined sides of the grate. Fig. 3 is a section on a larger scale through the grate-surface. Fig. 4 is an elevation taken from the rear. Fig. 5 is a front view with the head of the furnace cut off to expose the ends of the crucibles. Fig. 6 is a side elevation in section. Fig. 7 is a cross-section. These two views represent the furnace as portable Fig. 8 shows details on a larger scale of the manner of supporting the crucible-cylinders.

A is the combustion-chamber; B, the air-supply chamber, and D the dividing grate-surface, that is partly solid plates or surfaces *d d*, and partly a perforated plate or plates, D.

F is a pressure-blower connected with the chamber B. It may be a fan, a pump, or other suitable device for forcing in air under pressure, and it can be either directly upon the furnace where a portable apparatus is desired, or it can be placed at any point where it can be conveniently connected by a pipe, as *f*. This pump or blower is applied and operated in such manner as to produce a volume of pressure in the space or chamber under the fuel, and not to give a direct or concentrated blast under the grate.

The body or shell of the furnace being constructed of metal plates the interior surfaces of the two chambers A B are covered with suitable lining material, *a a*, where the metal requires protection.

The top of the combustion-chamber is arched, and from the crown an outlet, G, is upward through a pipe or chimney, G′, having a valve, H.

In the construction shown in Figs. 1, 5, 6, this valve is a stopper-plate fitting the top of the outlet and controlled in its movement by guides *h*. A number of weights, formed of rings $h^{\times}$ laid upon the plate, regulate the degree of pressure required in the combustion-chamber, and which will be reached before the valve can be forced up from its seat. Any other construction of weighted valve would answer.

The grate surface D is a metal plate with spaced holes *i*, funnel-shaped, the smaller end being at the top surface. For a large surface the plate D should be formed in sections adapted to be laid edge to edge lengthwise, as such construction will permit one part of the surface to be renewed when worn without condemning the whole plate. For this I should use thick bars, at least six inches wide on the face, and each one with two rows of funnel shape perforations, spaced in such manner that when the whole surface is laid these apertures will be about three inches apart. In small furnaces a single-plate surface can be used.

Movable plates J J are applied on both sides of this fuel-surface for covering a greater or less number of the apertures to increase or diminish the acting surface. These plates are either separate pieces, capable of being introduced into the chamber through the door A^2 and laid over the perforations on either side, or they are applied, as shown in Fig. 7, through slots in the sides of the chamber, so that they

slide in and out from under the edge of the inclined floors *d d* of the fuel-surface. They are supported partly on the grate-surface and at the outer edge on projections J×. By covering more or less of these openings the area of the grate-surface can be regulated to the quantity of fuel employed at any operation and the work to be done. By such means the pressure within the air-supply and distributing chamber, the area of the fuel-surface, and the temperature in the combustion-chamber are under control, and the degree of heat required in any operation, whether in smelting, distilling, or other processes, can be produced and regulated as necessary.

K K are retorts or crucibles of tubular form placed in the combustion-chamber with the ends carried outside and supported on roller-bearings *m m* on the end walls of the furnace. One end of each retort is also connected with suitable mechanism for rotating it upon these supports. These crucibles are cylinders of comparatively small diameter, or much smaller than has been heretofore employed. A number of them are arranged in the combustion-chamber in such manner as to permit ready connection of the whole set with a common driver. This is done by placing them in a circle at equal distance from a center, at which is mounted a large spur-wheel, N, and then fixing a pinion, M, upon each cylinder end to engage with the gear N. Power to drive the gear is taken from a shaft, *p*, by the pinion P. These cylinders are made of any suitable crucible material, and at the ends are provided with bearing-surfaces *k* to run on the rollers *m*. The weight of the cylinder and its contents is supported upon these rollers and not in the aperture in the walls of the chamber. These openings, therefore, can be readily packed and kept air-tight.

The metal rings *k k* are fixed on the ends of the cylinder by a packing of clay, and suitable packing is placed between the inner faces of the ring and the furnace-wall to make a close joint. Such packing is required more particularly at the rear end of the furnace, for at the front end a tight head or hood, R, forms an inclosure or chamber over the cylinder ends. This chamber is the receptacle for the products discharged from the cylinders, and as such products are sometimes gases and fumes or vapors, as well as sometimes solids, it is necessary to have the inclosure suitably gas-tight. It has an inclined bottom, R×, for discharging solid matter, and from the lowest point of the incline close conductors S S are carried into a sealing-trough of liquid, or terminate in a close chamber. They are also carried directly downward, or at suitable inclination for ready discharge.

An outlet, T, from the upper part of the chamber is provided for leading off fumes and gaseous products. These products can be taken out at the opposite end of the cylinder by leading a tube, V, Fig. 4, into the closed ends of the cylinders, and connecting this tube with a suitable condensing-chamber or a suction-chamber.

In the operation of obtaining sulphur and mercury the fumes could be drawn off at either end, and in operations where it is desirable to separate different gaseous products and remove them as formed both outlets being utilized to carry off the products in the order of their formation.

The ore or matter to be treated is fed into the end of the cylinder in a pulverized condition, and the means of feeding the matter should provide for the exclusion of air during the times of feeding. I have for this purpose placed a trough or hopper above the level of the cylinders and connected it to each cylinder by a closed spout or tube, W, having a bent end to enter the cylinder, provision being made to prevent the entrance of air between the end of the tube and the surrounding cylinder end, but not to interfere with rotation. Each tube has two slide-valves, X X, one located at the outlet from the hopper and the other between this point and the cylinder, to be operated alternately in the well-known manner. This construction also permits continuous feeding, as in ordinary roasting processes.

The portable furnace shown in Figs. 6 and 7 would be a convenient form for some localities, while for operations on a larger scale the other form, illustrated in Figs. 1, 4, and 5, would be used. In either construction the furnace will be set in an inclined position to facilitate discharge where the matter being treated would require such inclination in addition to the rotation in order to properly discharge it.

In the operation of such a furnace, whether of one or more cylinders, the fire will be started with the air-chamber open, and the chimney or outlet from the combustion-chamber uncovered until the fuel is brought to an incandescent state or is in a condition of active combustion and ready to receive the air under pressure. When this condition is reached, the openings are closed and the blower is started. The area of the air-feeding apertures having already been regulated in proportion to amount of heat required to be reached in the combustion-chamber, the air will be delivered in a volume uniformly under the whole active surface of the grate. The pressure in the combustion-chamber is then brought up to the required point by loading the valve H. This pressure will vary so greatly, and is governed in each case by the operation to be carried on, that no particular amount can be specified. I would place it at about five pounds to the inch, however, for the minimum practical amount in any operation, and from that increased indefinitely, accordingly to the structure of the furnace and the degree of heat to be employed.

Having thus fully described my invention,

what I claim, and desire to secure by Letters Patent, is—

1. The combination of the close combustion-chamber adapted to contain a body of incandescent fuel having an outlet governed by an adjustably-weighted valve and receiving a supply of air under pressure from a chamber beneath the fuel-surface and the retorts or crucibles located in the combustion-chamber over the fire and mechanism for imparting rotation to them, substantially as described.

2. The combination, with the crucible-cylinder situated within a close combustion-chamber over the fire and having the ends extended outside of said chamber and closed to the atmosphere, of a feeding mechanism or apparatus adapted to afford the introduction of the matter into the cylinder and to exclude the air at the time of feeding, a hood or chamber closing the other end with discharge-pipes terminating under water, and mechanism for rotating the cylinder, applied substantially as described for operation as set forth.

3. The herein described furnace, consisting of the retort-cylinders within and extending through a close combustion-chamber to permit feeding in at one end and discharge at the other end, a feed apparatus combined with one end for introducing the matter to be heated and for excluding air while feeding, a means for excluding air from the discharge end of the retort-cylinder consisting of the hood and discharge-pipes terminating under water, a mechanism by which rotation is imparted to the said cylinders, a fuel-supporting surface, and a fan-blower or equivalent air-supplying apparatus to deliver and distribute a body of air beneath and through the fuel into the combustion-chamber, and an outlet leading from the said combustion-chamber controlled by a valve, substantially as set forth.

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