

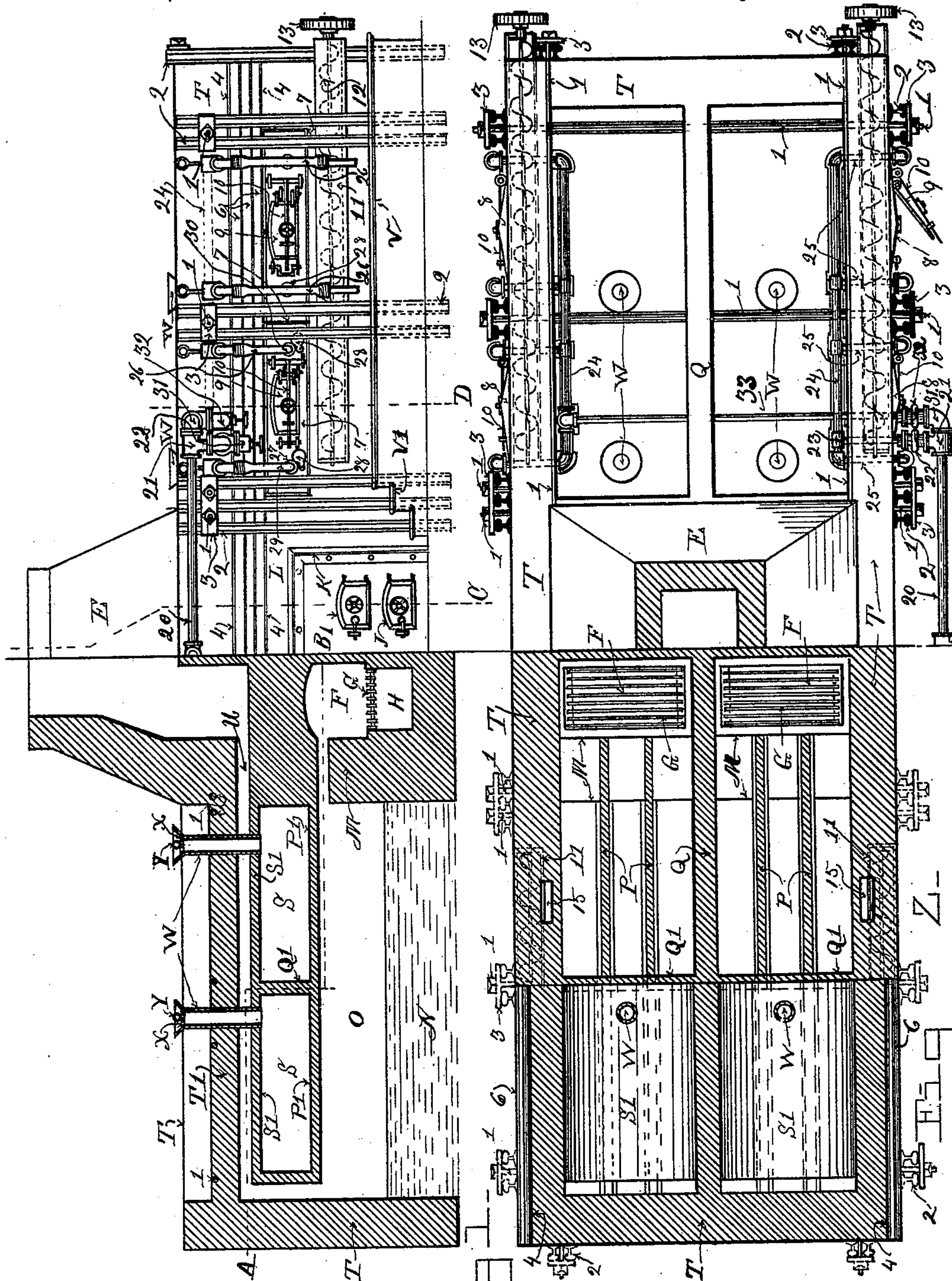
(No Model.)

2 Sheets—Sheet 1.

A. M. BEAM.
MUFFLE FURNACE.

No. 582,843.

Patented May '18, 1897.



Witnesses

J. W. Beam
T. Walter Beam

Inventor

By *Attorney* *John M. Beam*
H. S. Bailey

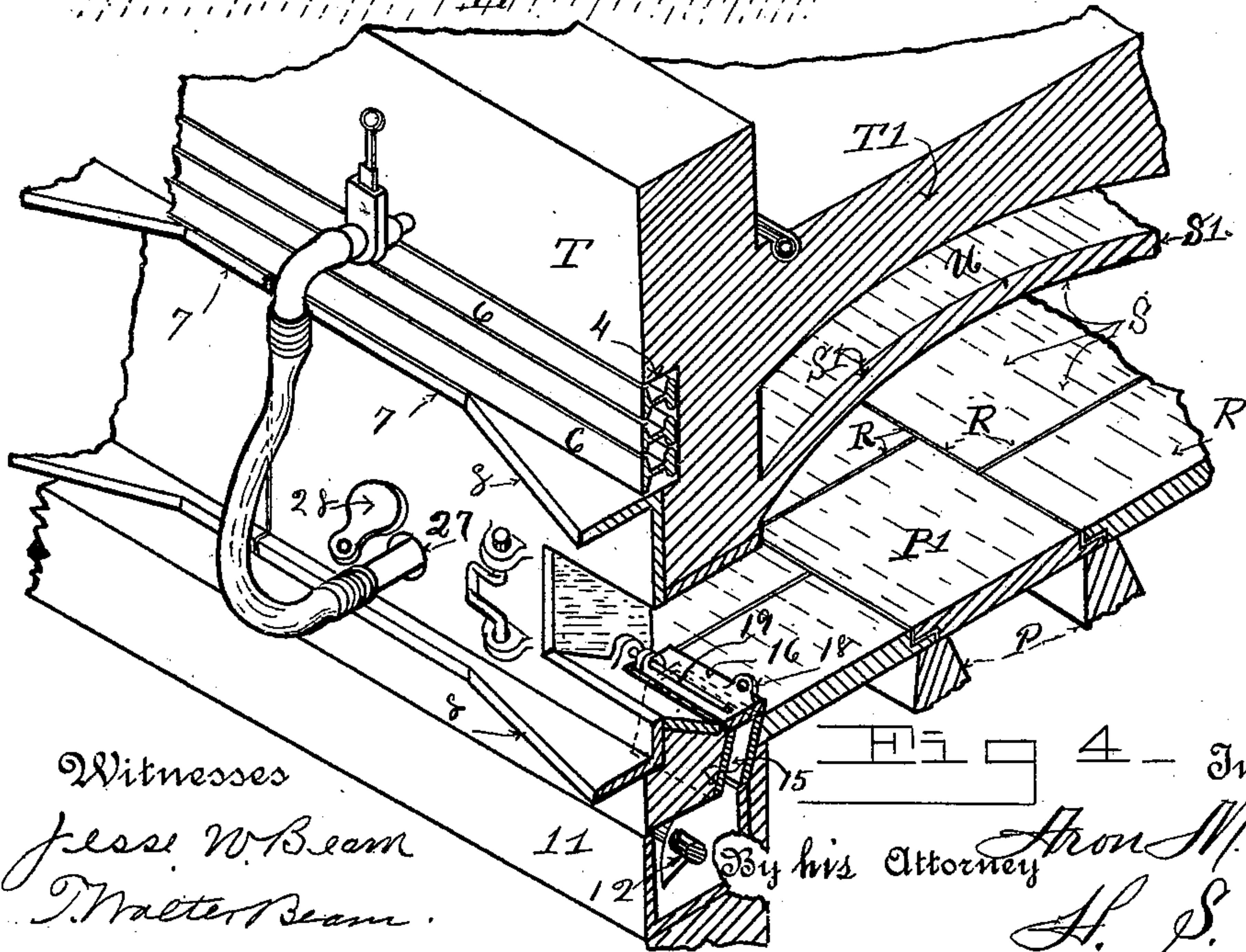
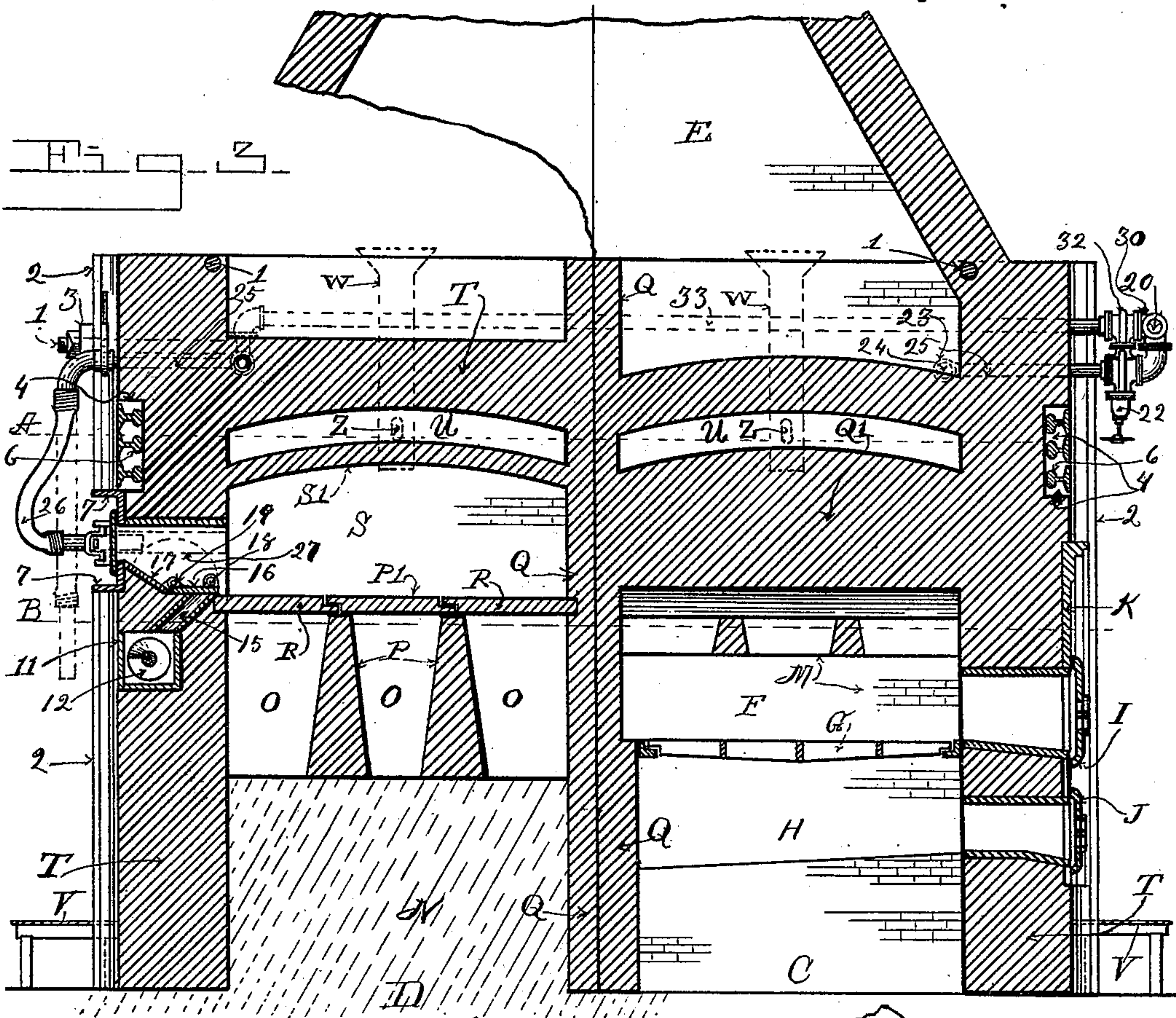
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UNITED STATES PATENT OFFICE.

ARON M. BEAM, OF DENVER, COLORADO.

MUFFLE-FURNACE.

SPECIFICATION forming part of Letters Patent No. 582,843, dated May 18, 1897.

Application filed July 6, 1896. Serial No. 598,218. (No model.)

To all whom it may concern:

Be it known that I, ARON MILLS BEAM, a citizen of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Muffle-Furnaces; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in muffle-furnaces; and the objects of my invention are to provide a new muffle-furnace adapted to unfold and control chemical changes in ores and other substances by the indirect application of heat of various degrees, whereby the operator may obtain at will and in a minimum space of time the desired chemical change and effect without the ores or substances being subject to the deleterious and injurious products of combustion of the fire-box. I attain these objects by the mechanism illustrated and described in the accompanying drawings and specification, in which—

Figure 1 represents a view of my improved muffle-furnace, showing one half of the view in elevation and the opposite half in longitudinal vertical section; Fig. 2, a general plan view of different parts and sections, one half of which is a plan view of the half shown in elevation in Fig. 1 and the other half shows two different sectional plan views of Fig. 3 on lines A and B; Fig. 3, a sectional end elevation at points C and D of Fig. 1, C designating the section through the chimney and D that through the ovens; and Fig. 4, a fragmentary perspective cross-section of one of the muffle-ovens.

Similar letters and figures of reference refer to similar parts throughout the several views.

Referring to the various views, it will be seen that my muffle-furnace comprises several muffles or ovens arranged in duplex order in a line on either side of a central chimney E. In the base of the chimney two fire-boxes

or combustion-chambers F are made on each side, one for each line of ovens.

G designates the grate-bars, under which is formed an ash-pit H. A door I of the usual furnace pattern opens into the fire-box, and a door J opens into the ash-pit. These doors are hung on a cast-iron frame K, which is built into the sides of the brickwork L of which the chimney and furnace are constructed.

M designates the bridge-wall of the fire-box.

N designates a filling of ground.

O is a passage extending under the muffles or ovens. This passage is divided lengthwise of the furnace, commencing at the fire-box, by two independent walls P, which are adapted to support the center of the muffles or floor P' of the ovens. The muffles or ovens are separated from one another by a central dividing-wall Q, which extends from the chimney through the length of the furnace and supports one side of the floor of the muffles or ovens. (See part D of Fig. 3.)

S designates the muffles or ovens, and S' the roof of the ovens. Several pairs of these ovens may be arranged in a row on each side of the chimney, depending on the capacity of the furnace required; but two pairs are shown. These are arranged in a line on either side of the chimney, which is positioned centrally between them in order to more conveniently carry off the smoke and gases from all of them and from the fire-boxes. The floor and roof of the ovens are constructed of fire-clay slabs. The floors are constructed of slabs R of fixed predetermined sizes. The edges of these slabs are rabbeted to allow them to overlap one another. They are made in sets, and each set comprises an oven-floor and is set in the furnace independent of the oven-walls in order that they may be removed and renewed at any time. The side walls are formed by the central division-wall Q between each opposite set and the outside walls T of the furnace. The roof of the ovens is arched, and at a space above the roof of the ovens a second floor is formed. The bottom of this second floor is arched concentric to the roof of the oven. The top of this second or main roof of the furnace is flat and is formed below the top of

the side and central division-walls in order to form an inclosure on the furnace in which to mix ore with such material as it is desired to combine with it and to heat the mass, which enables the operator to recharge the muffles or ovens with hot ore instead of with cold ore.

V designates a platform; V', stairs leading thereto. The platform is used by the operator when manipulating the ovens. The space U between the roof of the ovens and the main roof forms a passage for the smoke and gases from the fire-box, which pass under the ovens and up around the end of the last oven and through this passage U into the chimney. The capacity of each oven is gaged to suit the ore under treatment, varying from four hundred to seven hundred pounds for each separate oven. The ovens are separated from one another by a partition-wall Q'. A feed-chute W is arranged vertically in the brickwork into each chamber. They extend above the main roof of the furnace to about even with the top of the side walls and down through the roof of the muffles into each chamber. The upper ends of these feed-chutes are provided with funnel-shaped inlets, and a plate X is fitted to set into each and close it against the escape of the gases from the ovens, and in order to make the joint tight a shovelful of ore is generally thrown on them.

Y designates a ring placed in the top of each plate, through which a rod or pair of tongs may be inserted to remove the cover from the chute. Transversely through these chutes, at that part of them which is exposed in the flue-space U, I make an aperture Z, which is adapted to permit the gases to flow from the muffle into the lower end of the chute and from these apertures along the flue of the chimney. In order to strengthen the masonry, I bind it firmly together by tie-rods 1 and buckstays 2. The buckstays preferably consist of T-rails. These buckstays are placed vertically against the sides and end walls of the furnace, with their lower ends embedded in the ground in sets of two, spaced far enough apart to allow the rods to pass between them. A cross-strap 3 fits on the rods against the rails and the nuts are tightened against the cross-strap, thereby clamping the rails against the brickwork and holding the various parts of the furnace under compression. At a point approximately opposite the flue between the roof of the ovens and the main roof of the furnace I arrange in a recess 4, which I form in the brickwork on both sides of the furnace and opposite one another, a number of T-rails 6, laying them lengthwise along the whole length of the furnace. These are also arranged to be clamped against the brickwork by the vertically-arranged T-rails and the tie-rods. Just below these longitudinal rails I build in and secure to the side walls in any convenient manner a row of door-frames 7, which I preferably make long enough to place end to end from oven to oven along the furnace. (See Figs. 1 and 4.) These door-frames

are provided along their top and bottom edges with laterally-extending ribs 8, which are adapted to strengthen them. The doors 9 and their fastenings 10 are similar in construction to doors in common use on furnaces of this character. Below the doors on both sides of the furnace I build into the brickwork a conveying-chute 11, which extends along the front of the ovens. In this chute I journal a screw conveyer 12. This conveyer is operated by a pulley 13, secured at its exterior end, from a suitable source of power. In the floor of each oven and just inside its door I build a chute 15, (see Figs. 3 and 4,) which leads to the conveyer-chute. A cover 16 rests normally on the floor over the entrance to the chute. This cover is hinged to a plate 17, which extends at a downward incline from the sill of the door to the floor of the oven. The cover is provided with a ring 18, which enables the operator to swing it back on its hinge-pin 19 at will and open the chute to the spiral conveyer.

20 designates an air or steam supply pipe. This pipe enters one wall of the furnace from a T 21. Intermediate of this T and the wall I place a common form of gate-valve 22. The pipe which extends through the wall terminates in a T 23, and a pipe 24, which is embedded partially in the roof and extends along the roof parallel with the side wall and over each oven. A supply-pipe 25 for each oven is connected to it. These supply-pipes return through the wall, and to them is secured a short piece of hose 26. To the end of each hose a short piece of pipe is secured.

27 designates an aperture formed through each door-frame and brickwork into each oven's chamber. A cover 28 is pivoted to the door-frame and is adapted to be moved to close or open the aperture. Whenever a supply of air or steam is required in any particular oven, it is introduced through its respective aperture by inserting the pipe at the end of the hose of that oven into it, as shown at 29 and 30, Fig. 1, and in Figs. 3 and 4. To the T 21 an elbow 31 is secured, and adjacent to the elbow a valve 32, and from this valve a pipe 33 extends across the furnace to the opposite side, where a similar system and arrangement of pipe is made to provide either air or steam to the ovens on that side of the furnace.

The operation of the furnace is as follows: The ore to be treated is placed upon the main roof of the furnace, where it is mixed with such chemicals as will produce under sufficient and properly-regulated heat the desired chemical change. A sufficient charge is then shoveled into each oven through its respective chute, spread out and manipulated through the doors of each oven. The heat from each fire-box or fire-boxes passes under and around the end and over its respective row of ovens and practically surrounds them. They are thus heated and kept intensely hot by the products of combustion, and being

thus grouped together in sets retain the heat more evenly, cool slower during the recharging, and heat up quicker again after being recharged than if isolated from one another.

5 After a charge is properly arranged in an oven it is manipulated by the operator by stirring and by the introduction from time to time of hot atmospheric air, or, when required, steam, which may be introduced through the same

10 system of pipes by shutting off the supply of air at its source. Steam, however, is seldom used except with ores containing an excess of sulfur, as copper pyrites, or when coking coals or wood, where it coöperates with other

15 chemicals to free the gold contained therein, or to make charcoal or coke. If an excess of gases accumulates in the ovens the air-inlet is opened by pushing aside its cover, which creates a draft through the chute and the

20 aperture Z into the flue *u* that carries the gases into the chimney. Some ores do not require stirring while being treated, the action of the indirect heat upon the chemicals mixed with them being sufficient with ad-

25 missions of air when required to effect the chemical change desired, which is the complete separation of the gold from the ores, the ore being reduced to a powder and the gold freed from it and changed to a free and inde-

30 pendent state. After a charge is treated the chute-cover is turned back, which opens the entrance to the discharge-chute and the charge is drawn into the conveyer-chute, when it is carried to the end of the furnace

35 and discharged by the rotation of the screw conveyer. A new charge is then mixed with suitable chemicals and shoveled through its vertical chute into the oven. The ore on the roof and the air in the pipes are thus heated

40 by the radiation of the heat passing through the flue *u*. I am also able to make charcoal from wood and coke from coal. The construction of my improved muffle-furnace is such that I am able to treat ores and make

45 charcoal and coke in much less time than is consumed at present in their respective treatment and production. I am also able to hold the ore away from the oxygen until a chemical change is produced or until the sulfids

50 pass over into sulfates before any air is admitted, which prevents a loss in a great many ores that would occur from volatilization. One of the advantages of my system or construction and arrangement of the ovens is the

55 ability of the operator to repair or to replace the floors of the ovens, which is the only part that wears out and has to be replaced from time to time. This can be readily accomplished at any oven without suspending

60 the treatment of ores in the others or in the least checking the fires. The fire-clay tile of which the floor is constructed being either rabbeted at their edges, as shown in Fig. 3, or tongued and grooved, and the floors being all

65 of the same size, a set of floor-tile of fixed size and number is all that is required for each floor, and a worn floor can be removed

and a new one substituted for it in an hour or two at the most.

Having described my invention, what I 70 claim as new, and desire to secure by Letters Patent, is—

1. The combination in a muffle-furnace of one or more combustion-chambers, a chimney coöperating therewith, one or more muffle- 75 ovens integral with said combustion-chambers and chimney, a flue extending from the combustion-chambers under, around the farthest end of and over the top of said oven or ovens, means for introducing, manipulating 80 and discharging ores into and from said oven or ovens, and an air or steam supply pipe embedded in the masonry of the furnace in a position to heat the air passing therethrough by indirect heat radiating from said combustion- 85 chamber, a flexible or tubular feed-pipe connected with said air or steam supply pipe, an air or steam inlet aperture into said oven or ovens adapted to receive the free end of said flexible air-feed tube, means for closing and 90 opening said air-inlet and a gas and vapor outlet from said oven or ovens into said flues or chimney, substantially as described.

2. In a muffle-furnace the combination of a plurality of sets of two independent muffle- 95 ovens arranged back to back with a partition-wall between them and having each an arched roof, a combustion-chamber at one end, a flue for each line of ovens adapted to convey the products of combustion under, around 100 the ends of and over the arched top of said ovens, a roof-floor above said ovens, with a feed-pipe extending through said floor into said ovens having a transverse aperture registering with and adapted to form a gas-es- 105 cape passage from said ovens into said flue, a removable cover at the top of said feed-chute, doors leading into said ovens and a chimney at the end of said flues, substantially as described. 110

3. The combination of the muffle-ovens, the flues, the combustion-chamber, the chimney, roof drying-floor and feed-chutes, with a main air-supply pipe embedded in the masonry of the roof-floor, a feed-pipe extending from the 115 main supply-pipe to the front of each oven, a controlling-valve in each feed-pipe, a flexible pipe connected to the end of each feed-pipe, a nipple secured to the end of said flexible feed-pipe, an aperture through the front 120 wall of each oven adapted to receive said nipple and a cover, removably secured over the external end of said aperture, substantially as described.

4. In a muffle-furnace, the combination of 125 the combustion-chamber, the chimney, and the flues, with a series of independent muffle-ovens arranged back to back, each having a removable floor and an arched roof, an arch-shaped flue over said arched roof, a roof- 130 floor over each oven, a feed-spout extending through said floor into each of said ovens having a removable cover, an aperture through said feed-spout registering with said flue and

chimney, and a series of vertically-arranged buckstays at the sides and ends of said ovens and transverse and longitudinal tie-rods, substantially as described.

5 5. In a muffle-furnace the combination with the combustion-chamber, the independent, muffle-ovens and the flues, of a feed-trough constructed in the front wall of said ovens, a screw conveyer operatively secured therein, 10 means for operating said conveyer, an ore-chute connecting the floor of each oven with said conveyer and a pivoted door arranged to cover the entrance to said chute, substantially as described.

15 6. In a muffle-furnace the combination with the combustion-chamber and the chimney, of one or more sets of muffle-ovens arranged back to back, each having an arched roof and a removable, renewable floor, means for supporting said floor, with a cast door-frame secured 20 to the front of said ovens, a projecting rib along the top and bottom edges of said frame, a cast-door-frame jamb, extending through the front wall of said ovens, a door pivoted thereto, a downward-inclined floor to said door-jamb, a cast discharge-chute at the edge of 25 said door-jamb, projecting ears on the floor of said door-jamb and a swinging door pivoted to said ears and arranged to cover the entrance to said discharge-chute, substantially as described. 30

7. In a muffle-furnace the combination of the combustion-chamber, the chimney, the ovens and the flues, having an arched roof to 35 each oven, an ore-drying roof above said ovens having side walls extending above its level, feed-chutes through said floor and into said ovens, a gas-escape passage from each of said ovens through said feed-chutes into one of said

flues and a cover at the mouth of each feed- 40 chute, with longitudinal buckstays arranged in a recess along the opposite fronts of said ovens, vertical buckstays arranged against the fronts and opposite ends of said ovens and against said longitudinal buckstays, and 45 adjustable tie-rods connecting each opposing pair of vertical buckstays, and arranged to pass through the said roof-floor, substantially as described.

8. In a muffle-furnace, the combination with 50 the combustion-chamber, the flues, the chimney, the ovens and the ore-drying roof, of an air-supply pipe extending transversely across said ore-drying roof, an air-supply pipe built 55 into said ore-drying floor extending along the line of said ovens on each side of said ore-drying roof, lateral feed-pipes from said air-supply pipes extending to the front of each oven, a flexible pipe at the end of each of said 60 lateral air-feed pipes, having a tube at their ends and air-regulating valves in said pipes, with a cast door-frame having an aperture leading into each oven adapted to receive said tube of the flexible pipe, a cover for 65 said aperture, a door-jamb frame leading from said door-frame into each of said ovens, a screw conveyer built in the front side of the line of ovens, means for operating the same, a discharge-chute from each oven to 70 said conveyer and a door hinged to said door-jamb to cover the mouth of said discharge-chute, substantially as described.

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

ARON M. BEAM.

Witnesses:

J. N. BEAM,

F. WALTER BEAM.