(No Model.) 2 Sheets—Sheet 1.

P. MARLEY.

ORE ROASTING FURNACE.

No. 456,517. Patented July 21, 1891.

FIG. 1.

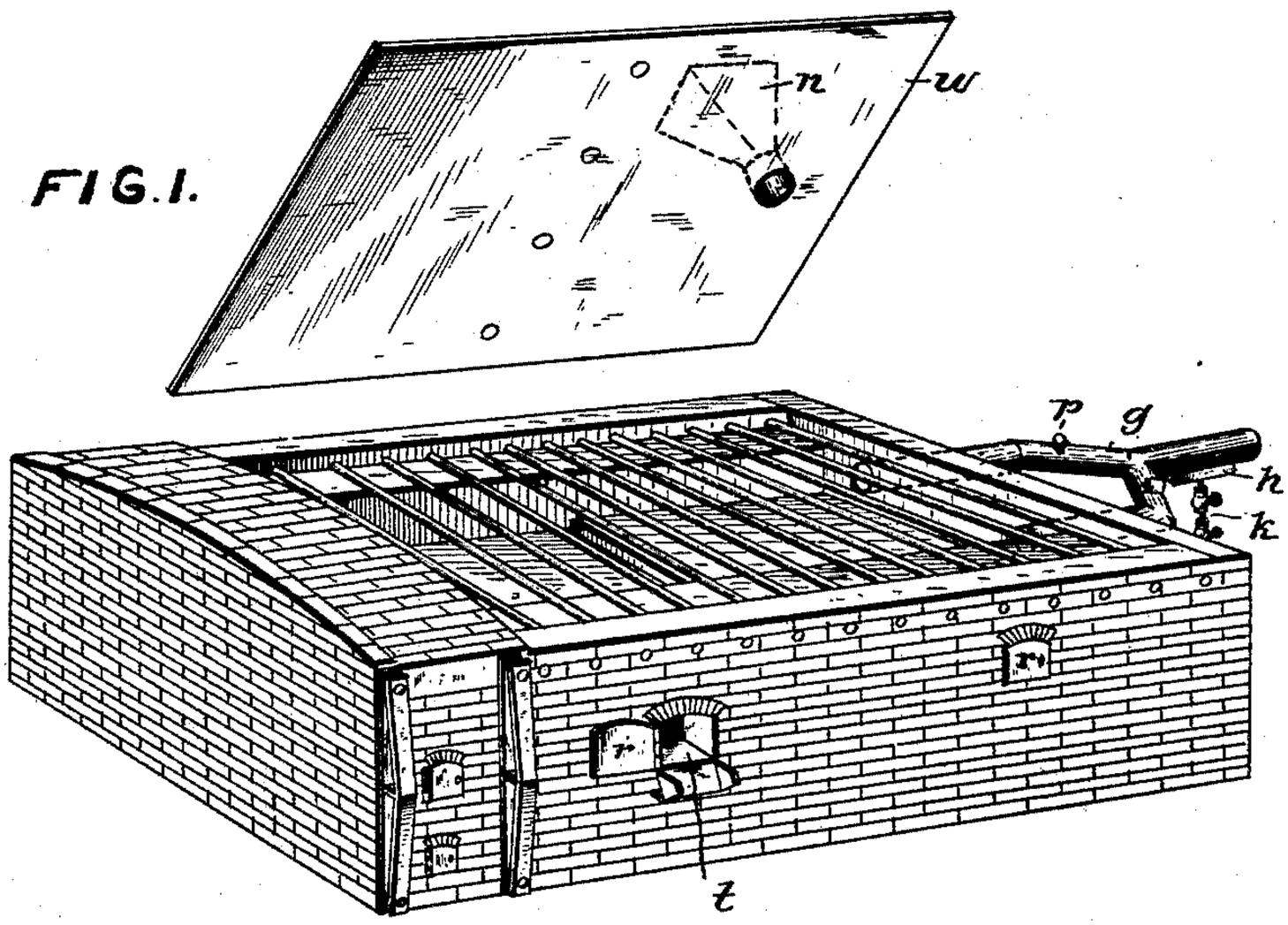
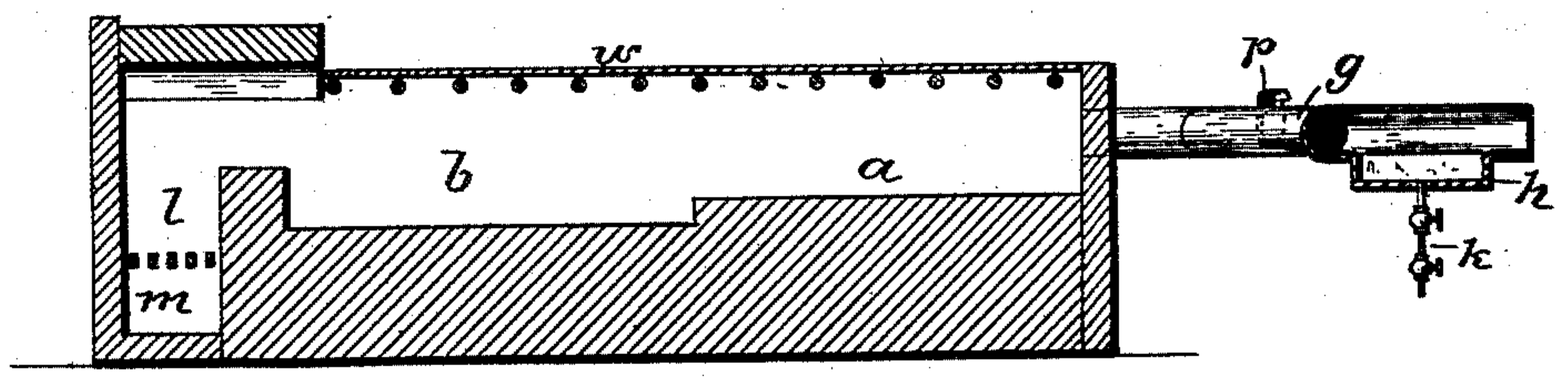


FIG. 2.



ATTEST.

J. Henry Kaiser.

Benj. Munson

INVENTOR.

Patrick Marley.

By F. M. Wale

Atty.

(No Model.) 2 Sheets—Sheet 2.

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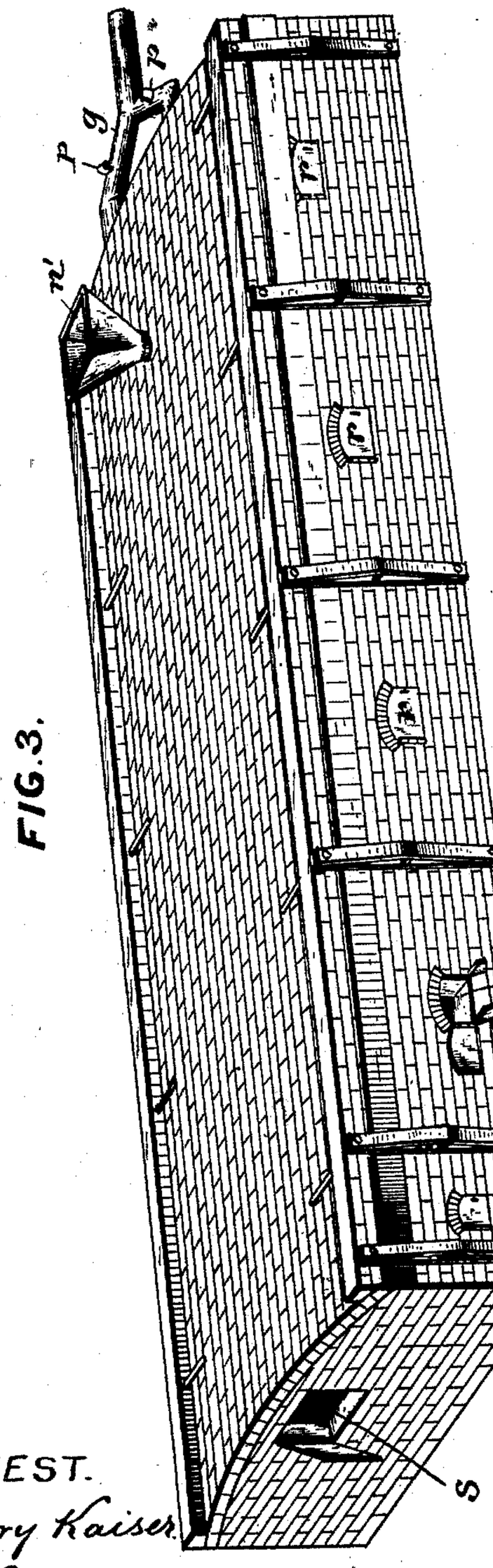

FIG. 3.

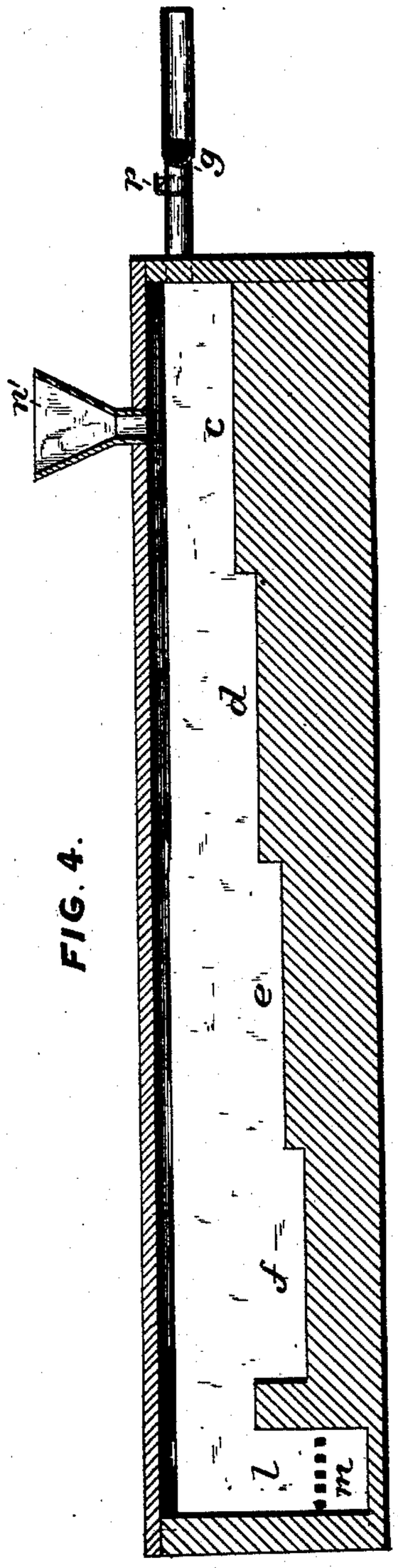

FIG. 4.

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UNITED STATES PATENT OFFICE.

PATRICK MARLEY, OF IDAHO CITY, IDAHO, ASSIGNOR OF ONE-HALF TO GEORGE H. ROBERTS AND J. H. RICHARDS.

ORE-ROASTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 456,517, dated July 21, 1891.

Application filed October 4, 1890. Serial No. 367,053. (No model.)

To all whom it may concern:

Be it known that I, PATRICK MARLEY, a citizen of the United States of America, residing at Idaho City, in the county of Boisé and State of Idaho, have invented certain new and useful Improvements in Ore-Roasting Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

The object of my invention is to provide apparatus for treating refractory auriferous and argentiferous ores, such as are found to exist generally in the western part of the United States, whereby the gold and silver will be thoroughly and cheaply separated from the base metals by gradually-applied heat when gold only is found in paying quantities and by such heat and the use of a small quantity of common salt when silver is found combined with the gold-bearing ore in sufficient quantity to warrant saving. I attain this object by the means hereinafter set forth, and carry my process into practical application by the use of the mechanical device shown in the drawings, wherein—

Figure 1 is a perspective view of my primary reducing-furnace. Fig. 2 is a longitudinal section of the same. Fig. 3 is a perspective view of my secondary reducing-furnace, and Fig. 4 is a longitudinal section of the same.

Like letters refer to similar parts throughout the several views.

The reducing-furnaces consist of a series of inclosed horizontal stationary beds or platforms of suitable dimensions, rising one slightly above the other as they recede from the fire-box, designated in the drawings *a*, *b*, *c*, *d*, *e*, and *f*, each furnace having a bifurcated flue *g*, the flue upon the primary reducing-furnace having attached on its under side beyond the point of juncture of the legs thereof a quicksilver-arrester *h*, having means of relieving it of its accumulations in valves *i* and *k*, which serves to arrest the escape of quicksilver when partly-amalgamated ore is being worked and prevents the salivation of operatives. The fire-box *l* and ash-pit *m* are of the usual construction, the fire-box communicating directly with the horizontal stationary beds or platforms. Feeding-funnels *n* and *n'* for the purpose of charging the furnaces are located at the end most remote from the fire-box. For convenience in handling the charge the horizontal stationary beds or platforms should be about eight feet wide and ten feet long.

The top of the primary reducing-furnace is removable for the purpose of regulating the heat, and may be constructed of sheet-iron. For the purpose of further means of regulating the heat I provide dampers *p p* in each leg of the flues in both furnaces.

To facilitate the manipulation of the ore on the beds, doors *r* are provided opposite each horizontal bed, and for the purpose of inspection and manipulation of the ore in the secondary reducing-furnace I provide the peephcle *s* in the end thereof.

The body of the furnaces may be constructed of brick or other suitable material, the beds presenting smooth surfaces.

I have found the mechanical device herein described best adapted to carrying my process into effective operation.

In carrying out my process I take the ore, either wet or dry, from the crusher and charge the horizontal bed *a* therewith, spreading the partly-comminuted ore evenly over the surface of the bed to a depth of about six inches. I subject the charge to a moderate heat for about two hours, the heat passing over the ore from the fire-box. It is important that the heat be evenly distributed throughout the fire-boxes of both furnaces, and for that reason I prefer to employ wood as fuel, cut approximately in lengths equal to the depth of the fire-box. During the time the ore remains on bed *a* I stir it twice. At the expiration of two hours I move the charge on horizontal bed *a* to horizontal bed *b*, next the fire-box, where I again spread it evenly and subject it to the action of the fire for about the same period and in the same manner as in horizontal bed *a*, stirring two or three times. On removal of charge from horizontal bed *a* I recharge that bed, as in the first instance, with ore from the crusher and proceed therewith as before. It is important to maintain a sufficiently low degree of heat in the primary

furnace to prevent the ore therein from fluxing, that being the tendency of sulphurets under a high degree of temperature, especially if the heat be quickly applied; but by heating the ore gradually that difficulty is obviated. At the expiration of about two hours, as heretofore set forth, I draw the charge from horizontal bar *b* through opening *t*, prepared for that purpose, and while the ore is hot I transfer it to horizontal bed *c* in the secondary reducing-furnace through the funnel or chute *n'* of that furnace, Fig. 4, spreading the ore evenly over the surface of the bed, as in the primary furnace. The ore is here subjected to a much higher degree of heat than in the primary reducing-furnace. It should occupy this bed about two hours, during which time it should be stirred once or twice. At the expiration of the time specified the ore on bed *c* should be moved to bed *d*, where it is subjected to the same treatment and permitted to remain for the same period as on bed *c*. It is then removed to horizontal bed *e*, which it should occupy about two hours, during which time it should be stirred three times. Then it should be removed to bed *f*, which it should also occupy about two hours, during which time it should be stirred four or five times. It will be noticed that the charge of ore receives substantially the same treatment on each successive stationary horizontal bed, except that on the two beds last occupied *e* and *f* the process of stirring is more frequent than upon the preceding beds. As the fire-box is approached, the heat becomes more intense. As each bed is relieved of its charge by transfer toward the fire-box or its removal from the furnace, the bed so relieved is occupied by the charge immediately following, the bed *a* being successively charged when relieved by ore from the crusher, as above stated. It will be thus seen that it requires about twelve hours for a single charge to pass over all the beds and that the heat being uniform in the respective furnaces the charge undergoes a gradual increase of heat from the time it enters on stationary horizontal bed *a* until the highest degree of heat is reached on stationary horizontal bed *f*. A high degree of heat should be maintained at stationary horizontal bed *f* in the secondary furnace—say about 400° Fahrenheit. After the charge has passed over each stationary horizontal bed and been subjected to heat as described and remained the required two hours on bed *f*, I draw the charge through opening *u*, Fig. 3, and allow it to cool. When cool, it is prepared to be subjected to concentration by being passed through any approved dry concentrator.

If silver is combined with gold in the ore in sufficient quantity to justify saving the silver, I use from one to five per cent. of common salt to convert the silver present into a chloride, mixing the salt with the ore on introducing the ore into the primary reducing-furnace, but not otherwise varying the process herein described.

I am well aware that salt has been used before to assist in reducing refractory metals contained in gold and silver bearing ores; but by my process I am enabled to wholly dispense with salt or any other chemical in working ores bearing gold only in paying quantities, and in silver-bearing ores combined with gold, where it is desirable to save the silver, I use but a small quantity of salt, as heretofore stated.

In the drawings but two beds are shown in the primary furnace and four beds in the secondary furnace. More beds may be used in carrying out my process; but the time consumed on each bed should be reduced in proportion to the increased number of beds employed.

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

In a furnace having a fire-grate with removable top and stepped hearths, an outlet-flue having two branches leading from the furnace-chamber at the end remote from the grate to a common conduit, valves arranged on each branch of the flue, and a mercury-arresting pan arranged in the wall of the conduit near the branch of the flues, having a valve and draw-off pipe, as and for the purposes described.

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

PATRICK MARLEY.

Witnesses:

JOS. VOSHAY,

JAMES W. WHITE.