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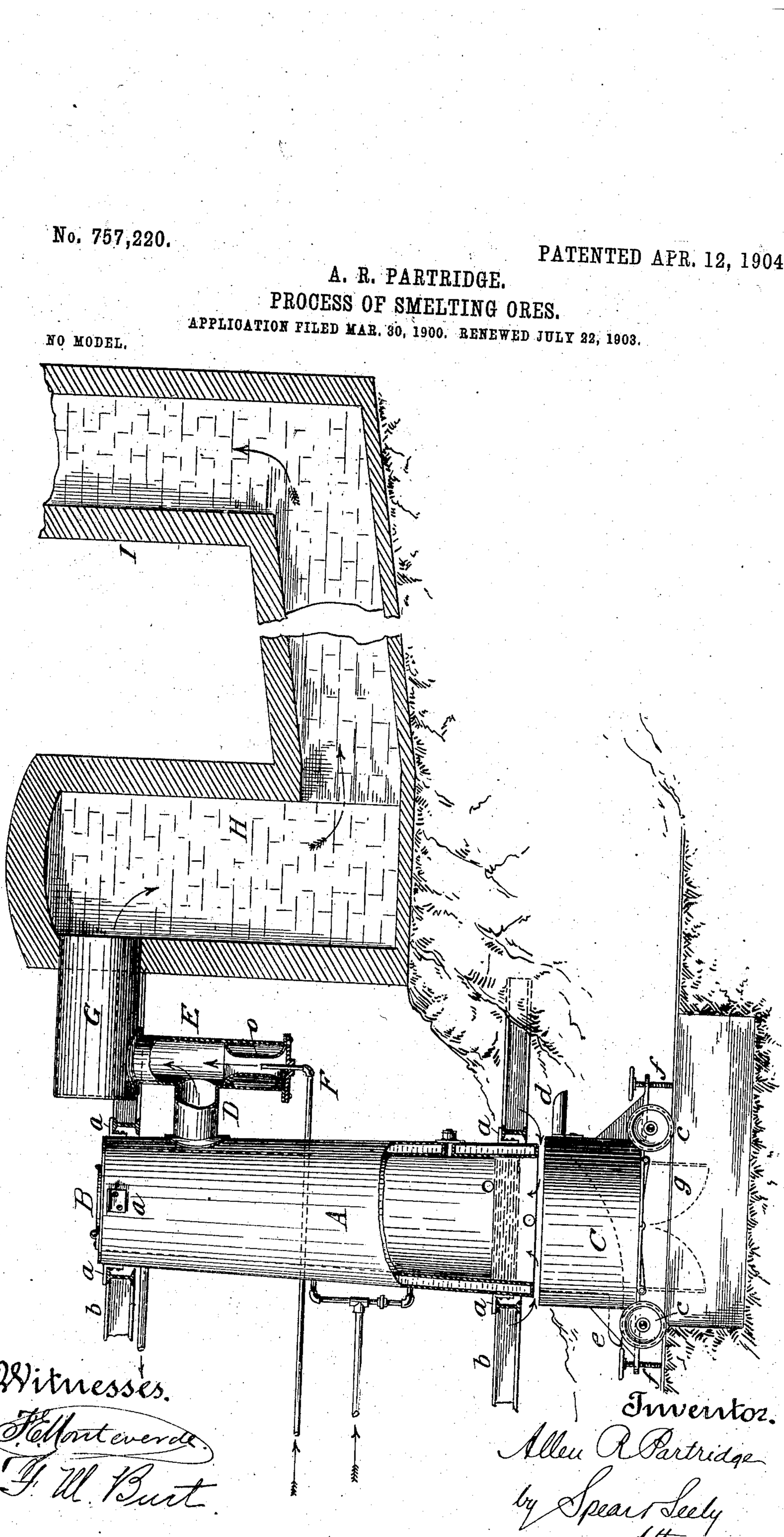
A. R. PARTRIDGE.

PROCESS OF SMELTING ORES.

APPLICATION FILED MAR. 30, 1900. RENEWED JULY 22, 1903.

NO MODEL.



Witnesses.

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No. 757,220. Patented April 12, 1904.

UNITED STATES PATENT OFFICE.

ALLEN R. PARTRIDGE, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF ONE-HALF TO FRANK W. PAGE, OF SAN FRANCISCO, CALIFORNIA.

PROCESS OF SMELTING ORES.

SPECIFICATION forming part of Letters Patent No. 757,220, dated April 12, 1904.

Application filed March 30, 1900. Renewed July 22, 1903. Serial No. 166,635. (No specimens.)

To all whom it may concern:

Be it known that I, ALLEN R. PARTRIDGE, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Processes of Smelting Ores, of which the following is a specification.

My invention relates to the treatment of ores by smelting to obtain precious or valuable metals, such as gold, silver, mercury, copper, and lead.

One part of my process relates to the operation of smelting, and consists in producing a vacuum in the smelter for establishing and maintaining a more effective and uniform draft, for producing and maintaining a hotter smelting zone, and for accomplishing these objects at a material reduction of operating expense; but the vacuum method of producing the draft in the smelter also bears a definite and important relation to the second part of my process, by which gases or fumes containing or carrying valuable material are condensed or precipitated, and thus saved.

The apparatus which I prefer to employ for carrying out my process is illustrated in the accompanying drawing in a single sectional view. I do not limit myself, however, to such apparatus, as my process can be carried out by other apparatus differently constructed, but of course embodying the features essential to the proper carrying out of my process.

In the drawing, A represents a stack supported in any suitable way, as by the angle-brackets *a* and beams *b*, the latter forming part of some suitable supporting structure. The stack may be constructed of iron and water-jacketed, as shown, or built of brick or masonry, as may be preferred. It is entirely open at the bottom.

B represents the charging-door at the top.

C represents a separate hearth, which I prefer to make portable by mounting it upon carrying-wheels *c*. This hearth forms a movable bottom for the open stack, and it is also adjustable vertically, so as to increase or diminish the distance of its upper edge from the bottom of the smelter. It is provided with a slag-spout *d* and with a draw-off spout *e*, adapted to be closed, but to be tapped when the matte, bullion, or other material is to be removed. The vertical adjustment of the hearth can be accomplished in many different ways. I have shown the whole hearth bodily movable by means of screws *f*, bearing on the tracks *g*.

Between the hearth and open-bottomed stack a continuous draft-space thus exists, controllable as to size and adapted to admit a flow of air uniformly throughout its extent. I attach great importance to this manner of admitting a continuous and undivided volume of air to the smelter instead of using blast or forcing means and twyers, which supply the air in separated jets.

When the furnace is charged with ore and fuel or with ore alone, which from its nature forms a fuel, and combustion is taking place, a narrow smelting zone is established, as indicated roughly by dotted lines, a few inches above the open bottom, and the air entering uniformly and unbrokenly and without previous heating is immediately exposed to the intense radiated heat from the zone before reaching the latter, and this radiation takes place uniformly throughout the extent of the air flow, since there are no cross-currents, but only a uniform flow. Thus without previous heating and without expensive mechanical forcing devices I produce a hotter and more effective smelting zone at a considerable reduction in expense.

The necessary draft is produced in my process by exhaust or suction operating to produce a vacuum in the stack, and I do this by means of a steam-injector operating in connection with an outlet from the stack for products of combustion. Near the upper end of the structure is the escape-pipe D, which communicates with a flue E, which may extend vertically or at any angle, provided that it extends across the end of the pipe D. Within the flue E and near its end its inner diameter is reduced by a plug *o*, which forms an injector-nozzle. A pipe F enters steam-tight through the closed end of flue E, through which steam from any suitable boiler is supplied and injected through the plug and past the outlet,

beyond which it expands to the size of the flue E, making practically a piston of steam beyond the outlet and causing an extraordinary draft. No steam-injector whose jet enters beyond the outlet from the furnace can produce a draft approaching in energy that realized from this injector, which enters at one side of the outlet, discharges past it, and expands beyond it to form a steam-piston. Further, the steam leaving the flue enters the enlarged stack, in which it is freed to such an extent as to prevent any back pressure. The injector tends to produce a vacuum in the stack, which of course causes a strong inflow of air from below in the manner already described. I may mention here that air under pressure may be used as an injector for creating a vacuum in the stack and producing the draft, and although in such case I should be put to the expense of air-forcing devices I should still obtain an economical advantage over the use of such devices for producing the draft by direct pressure from below. This will be understood by reference to the previous description of the character of the draft in my smelter, which cannot be produced by direct pressure, but can be produced by any effective means for causing a vacuum in the stack.

The use of steam, however, as an injector is to be preferred, partly on account of its economy, but principally because it has an important bearing upon the remainder of the process. When the composition of the ore is such that it carries metals capable of being volatilized wholly or partly, so as to escape from the stack as fumes, or when valuable dust is carried out of the stack, fumes or dust combine with the steam in the external flue and are carried along with it. By liberating the steam in a suitable chamber it is permitted to cool naturally and condense the fumes and to precipitate the valuable dust, which has been made heavier by saturation, while the worthless material escapes. In the drawing, G shows an enlargement of the flue E, which enters the dust-chamber H, in which the operation just described takes place and which is provided with a stack I, through which the worthless materials escape. It will thus be seen that in the continuous process described I obtain a twofold advantage by the use of steam at a single point—first, in producing an effective draft economically and at the same time accomplishing the saving of whatever valuable material escapes from the smelter.

I do not wish to be limited to the exact manner of injecting air or steam hereinbefore described, and shown in the drawing. Under some circumstances it would be feasible to inject the fluid directly into the stack above the charge, where a contracted diameter would be provided, so that the vacuum would be produced below.

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

The herein-described method of smelting ores consisting in admitting air freely at atmospheric pressure to the bottom of the smelter, and producing a suction at the top of the smelter by injecting a jet of steam or air through a relatively narrow passage, causing said steam or air to pass transversely an outlet from the upper end of the smelter and to then expand to fill a relatively wider passage beyond said outlet, substantially as described.

In testimony whereof I have affixed my signature, in presence of two witnesses, this 19th day of March, 1900.

ALLEN R. PARTRIDGE.

Witnesses:
F. W. PAGE,
L. W. SEELY.