(No Model.)

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APPARATUS FOR COMPRESSING AND AGGLOMERATING ROASTED ORES OR OTHER MATERIALS.

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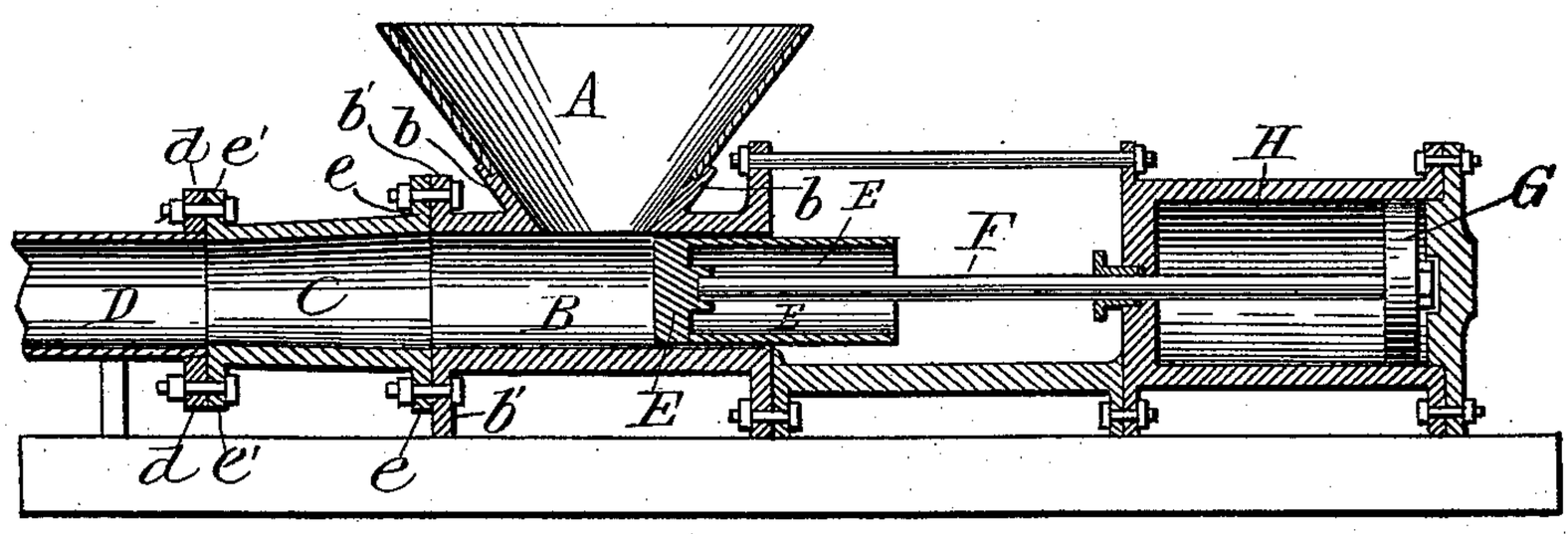

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UNITED STATES PATENT OFFICE.

JAMES WILSON NEILL, OF SALT LAKE CITY, UTAH.

APPARATUS FOR COMPRESSING AND AGGLOMERATING ROASTED ORES OR OTHER MATERIALS.

SPECIFICATION forming part of Letters Patent No. 570,947, dated November 10, 1896.

Application filed February 15, 1895. Serial No. 538,538. (No model.)

To all whom it may concern:

Be it known that I, JAMES WILSON NEILL, a citizen of the United States, residing at Salt Lake City, in the county of Salt Lake and Territory of Utah, have invented certain new and useful Improvements in Apparatus for Compressing and Agglomerating Roasted Ores or other Materials; and I do hereby 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.

The objects of this invention are to cheapen and to facilitate the treatment of the ores of lead, copper, iron, gold, silver, and other metals; and my invention relates to the agglomeration of said ores and metals by pressure while in a red-hot or incandescent state. I attain these objects by the mechanism illustrated in the accompanying drawing, which is a longitudinal section of my machine.

The sulfid ores of lead, copper, iron, gold, silver, and other metals require for their successful treatment by the smelting process a preliminary roasting operation to eliminate the sulfur and other impurities. This roasting operation can be carried out in various kinds of furnaces, and to render the operation more complete and speedy and less expensive the ores are usually first crushed by suitable machinery to a suitable or desirable degree of fineness, usually about one-fourth inch diameter for the largest pieces. The operation of roasting often reduces this size still further through the decrepitation of the minerals upon exposure to heat. Thus the product of the roasting operation is usually a powdery material, which is not a desirable one for the succeeding treatment in the blast-furnace, and for the following reasons: The fine powdery material packs in the blast-furnace and impedes the operation by retarding the passage of the blast and by adhering to the walls, or when a favorable opening occurs this powdery material runs through the same and disturbs the even mixture of the charge, sometimes even reaching the twyers in a raw condition and causing serious disturbance; also the pressure of the blast carries large quantities of this dry powdery material out of the furnace into dust-chambers and flues, where it settles, causing increased cost of extraction, as well as other losses, &c. To avoid these and other disadvantages caused by the powdery condition of this roasted product, some roasting-furnaces are arranged to deliver their roasted products into a lower hearth or furnace, in which it is subjected to a higher degree of heat and thereby melted together or "slagged" and then removed in suitable manner, the product being thus agglomerated and made more suitable for further treatment in the blast-furnace. This method of treating the roasted ore is expensive on account of the extra cost for fuel and also on account of the increased losses in precious and base metals caused by the intensity of the heat necessary. Hence this method is being abandoned. Still other furnaces are arranged to heat the roasted ore to a degree somewhat less than that necessary to melt or "slag" the material, but high enough to make the product of a pasty consistency, "sintered," and this is then removed from the furnace, the product remaining in a more or less agglomerated condition. This operation is less expensive and wasteful than that of "slagging" the roasted material, but it is open to the same objections.

Many ores cannot be either slagged or sintered owing to their composition.

To do away with these difficulties, to cheapen the roasting operation, as well as to produce a roasted material which shall be in a solid compact form most suited to subsequent smelting operations, I have invented the following-described apparatus for and method of treatment of roasted ores. This is based on the fact that roasted ores, if taken when yet in a red-hot and incandescent condition and subjected to high pressure, become agglomerated, the particles adhere together, and, after cooling, remain in compact form. This method of and apparatus for handling roasted ores (or other materials) can be attached to and made to handle the product of any of the well-known and usual roasting-furnaces. It is simple, inexpensive in construction and operation, makes a product which is admirably suited for further smelting operations, and avoids all expenses and losses incident to the operations of slagging or sintering as now practiced.

This apparatus or machine consists, essen-

tially, of two main parts: first, the apparatus for the compression and agglomeration of the red-hot and incandescent material, and, second, the apparatus or machine attached to and furnishing the power to the first part for the performance of the desired work.

First. The apparatus for the compression of the red-hot materials consists, preferably and essentially, of the following parts, as illustrated in the drawing herewith attached:

The hopper A, with inclined or slanting sides, conveys the red-hot ore (or other materials) to the receiving-chamber B, which is preferably cylindrical, but may be of any desired shape in cross-section, having an opening in its upper side and provided with an integral flange *b*, surrounding the said opening, and within which the hopper A is firmly secured. The receiving-chamber B has upon its outer end, and surrounding the same, the flange *b'*, with holes therein, through which bolts or rivets are passed and by means of which the said chamber B is securely fastened to the inner and larger end of the compression-chamber C. This chamber C is constructed with projecting flanges *e e'* at its inner and outer end, respectively, forming parts of the same, and provided with holes through which bolts, and nuts thereon, or rivets, if desirable, are inserted, and by means of which the said chamber C at its larger and inner end is secured to the receiving-chamber B and at the outer and smaller end thereof to the inner end of the cooling-pipe D, which is also provided with a similar flange *d*, having holes therein. To this chamber is attached the compression-chamber or reducer C. This is preferably a truncated cone in shape, but it may have any other shape similar in cross-section to the chamber B. The area of the cross-section next to the chamber B is always larger than at the opposite end. To this reducer or compression-chamber is attached the delivery and cooling pipe D. Movable in the chamber B, and made to fit it closely, is the plunger E, which, when operated, has a stroke always less than the entire length of the chamber B. This plunger E is attached to and operated by the connecting-rod F, which in turn is operated by and transmits the power from the machine employed for that purpose. In the drawing this connecting-rod is represented as connected with the piston and cylinder of a steam-engine, the automatic valve of which is omitted from the sketch for simplicity's sake.

The second part may consist of any suitable apparatus or machine capable of furnishing the necessary power, and the kind of or arrangement of this apparatus is immaterial to my invention.

In operating this invention the method is as follows: A portion or charge of the ore or other material still red-hot and glowing as it comes from the furnace is delivered through the hopper A into the receiving-chamber B, the plunger E being at the end of its stroke to the right, as shown in the drawing. Hereupon the automatic valve-gear attached to the cylinder H admits steam into the cylinder H behind the piston G, forcing it, and with it the plunger E, to the left the length of the cylinder or stroke. This movement of the plunger forces the charge of red-hot ore through the chamber B into the compression-chamber C and leaves it there as the plunger and piston, actuated by the automatic gear, return to their first position. The movement of the plunger opens and closes the opening from the hopper A into the chamber B, and its movement is so regulated that it makes about ten strokes (more or less) per minute. On the reopening of the bottom of the hopper A a second portion or charge of red-hot ore is admitted to the chamber B, and the next stroke of the plunger moves this charge to the left and forces it against the former charge which remained in the opening of the compression-chamber C. As the area of the cross-section of this chamber is constantly decreasing, the friction between the material and the chamber-walls is increased. Hence it requires more force to move the material forward. Hence both charges are compressed, both by the reduction in their cross-section area as well as by the pressure of the one charge against the other. The plunger forces the second charge into the place of the first, moving that one forward, and, returning, repeats the operation with still another charge of the red-hot material. This action goes on regularly and continuously, the compressed and agglomerated ore being successively forced out of the chamber C into and through the chamber or conveying-pipe D, where it also cools and any gases which it may give off can escape, the diameter of cross-section area of this pipe being larger than that of the blocks of compressed and agglomerated ore.

The difference in area of cross-section between the two ends of the compression-chamber C can be varied to suit different materials. In some cases it may not be necessary to use any tapering chamber, the weight of the ore and the friction against the cylindrical chamber-walls producing sufficient resistance to effect the necessary degree of compression and agglomeration. In such case the chamber C would be omitted and the pipe D attached directly to the chamber B.

The operation of this apparatus is simple, inexpensive, and automatic. A machine with a plunger six (6) inches in diameter making ten strokes per minute will compress approximately fifty tons of ore in twenty-four hours. Thus first cost is small. The saving in metal losses and in increased capacity of blast-furnaces consequent upon the use of this compact roasted product make this process of great value and importance.

What I claim is—

1. In machines for compressing and agglomerating red-hot and incandescent ores, or other materials, the combination of the re-

ceiving-chamber B, provided with an opening in the upper side thereof, an integral flange surrounding the said opening, hopper A, having inclined or slanting sides, rigidly secured within the said integral flange, the plunger E, of the engine adapted to reciprocate within the receiving-chamber, the compression-chamber C, larger at its inner, than at its outer end, in horizontal alinement with, and attached to the said chamber B, and the cooling-pipe D, attached to the outer end of the said compression-chamber C, substantially as herein shown and described.

2. In machines for compressing and agglomerating red-hot and incandescent ores, or other materials, the combination of the receiving-chamber B, provided with an opening in the upper side thereof, integral flange *b*, surrounding the said opening, and flange *b'*, at its outer end for attaching the same to the compression-chamber C, the hopper A, having inclined or slanting sides, rigidly secured within the said integral flange *b*, the movable plunger, E, adapted to reciprocate within the chamber B, the compression-chamber C, with flanges *e e'*, at its ends, forming parts thereof, for the purpose of attaching the same, and the cooling-pipe D, provided with the flange *d*, surrounding its inner end, substantially as shown and described.

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

JAMES WILSON NEILL.

Witnesses:
M. E. CALLAHAN,
W. V. EBERLY.