(No Model.)

O. B. PECK.

STEAM GENERATOR.

No. 385,425. Patented July 3, 1888.

Fig. 2.

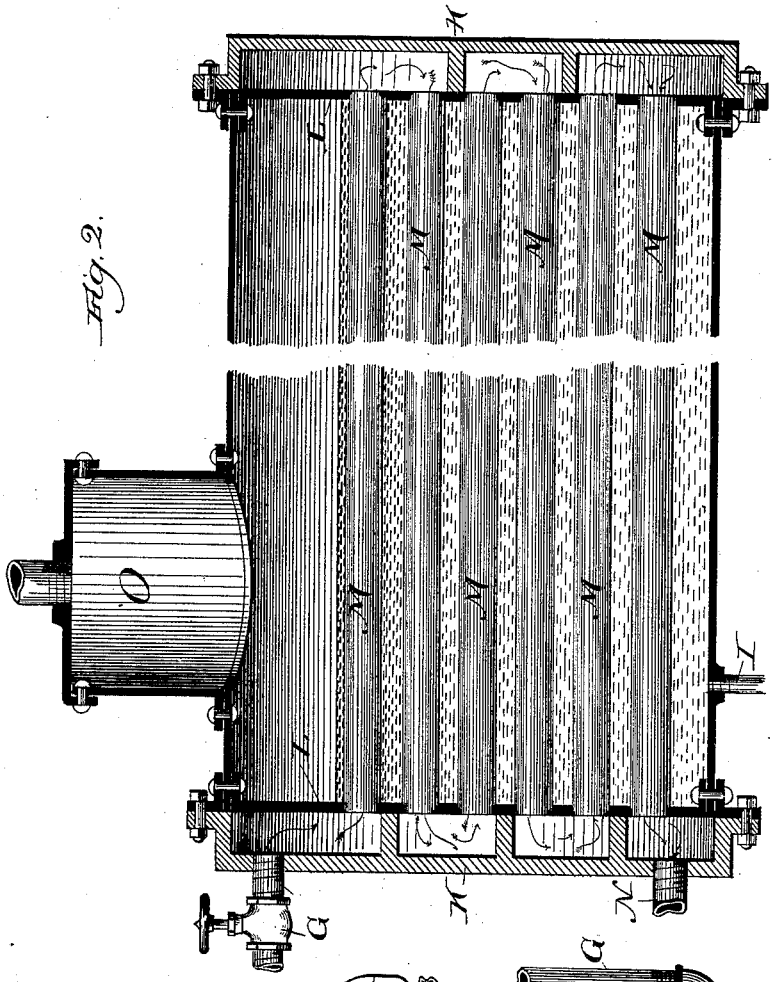
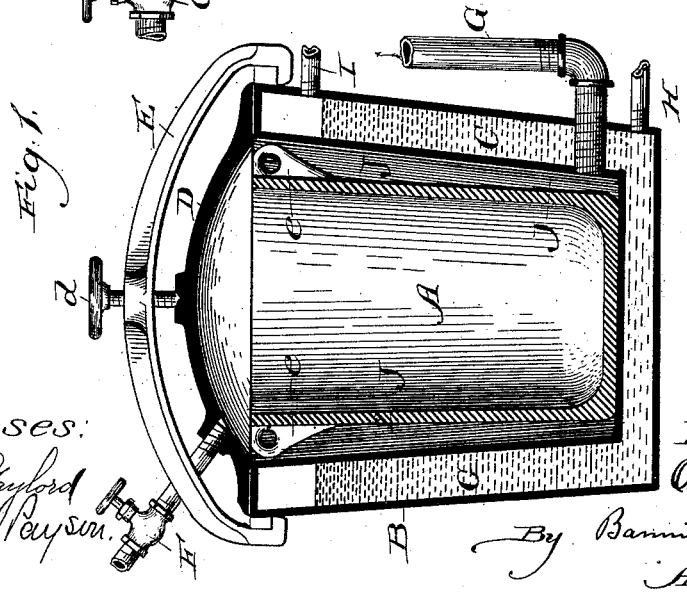


Fig. 1.



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UNITED STATES PATENT OFFICE.

ORRIN B. PECK, OF CHICAGO, ILLINOIS.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 385,425, dated July 3, 1888.

Application filed September 26, 1887. Serial No. 250,678. (No model.)

To all whom it may concern:

Be it known that I, ORRIN B. PECK, a citizen of the United States, residing at Chicago, Illinois, have invented certain new and useful Improvements in Processes for the Generation of Steam, of which the following is a specification.

The object of my invention is to devise a means by which the heated slag of smelting-furnaces may be utilized in the production of steam; and my invention consists in the process hereinafter described and claimed.

The apparatus which I employ is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical sectional view of my primary steam-generator, and Fig. 2 is a longitudinal vertical view of my secondary steam-generator.

In the drawings, A represents a box or receiver in which the molten slag is placed; B, a receptacle large enough to permit the receiver A to be placed within it; C, a water-space between the inner and outer walls of the receptacle B; D, a top or cover to the receptacle B; *d*, a screw and wheel by which the cover may be raised or lowered; E, a yoke in which the screw *d* is located and supported; F, an inlet by which steam or water may be introduced into the box or receiver A; G, a pipe leading from the interior of the receptacle B and entering the head or end of the secondary steam-generator, (where a secondary generator is employed;) H, a pipe for the introduction of water into the water-space between the walls of the receptacle B; I, a pipe to convey water from the space between the walls of the receptacle B; J, a steam-space between the box or receiver A and the inner wall of the receptacle B; K, the outer head of the secondary steam-generator; L, the inner head of the same; M, heating-tubes into which steam is introduced to convert the water in the secondary steam-generator into steam; N, a pipe for discharging the steam which is passed through the tubes M, and O a steam-dome of the secondary steam-generator.

As is well known, there is produced in the smelting of iron, gold, silver, copper, and other ores a large quantity of slag, which consists of the silicious residue after the extraction of the metal. This slag, at the time it is discharged from the smelting-furnace, is at a very high temperature—viz., that of molten metal. It is usually dumped in some convenient place and allowed to gradually cool without the great heat which it contains when discharged from the furnace being utilized. I have conceived the idea of employing the heat contained in this molten slag for the production of steam by bringing water in contact with it while confined in a closed chamber; and I have found by practical experience in the use of slag for this purpose that it is especially adapted for the generation of steam in the manner described. For example, a mass of hot slag, when confined in a closed chamber and subjected to the action of water or steam, cracks, splits, and chips, so that it continually exposes a fresh heating-surface for the water or steam. This property of gradually developing steam from the latent heat of a substance which rapidly disintegrates on the surface is peculiar to slag, and I find that I am thus enabled to produce steam in a more uniform manner than by means of heated metal or like substances.

The particular apparatus shown in the drawings by which I carry my process into effect consists, preferably, of two main parts, which, for convenience, I have termed the "primary" and "secondary" steam-generators. I will describe each of these means in the order of their use.

In making my primary steam-generator for carrying out my process of utilizing the heat of molten slag I make a receptacle, B, which I prefer to have provided with double walls and a water-space between them to prevent overheating. This receptacle B is intended to be covered closely when in use, and to that end I provide a cover or top, D, which is adapted to fit closely upon the top of the receptacle B. I also provide a yoke, E, supporting a screw, *d*, for raising and lowering the cover D and holding it securely in place when subjected to pressure from within. These parts and their arrangement and operation will be apparent from Fig. 1 of the drawings; and I will say here that as the object of these parts is to make a steam-tight recepta-

cle they may be changed in various ways, as may be desired. I attach no special importance to the particular means illustrated and described, so long as they afford me a large steam-tight receptacle. I preferably employ a box or receiver, A, which may be made of any proper material, so long as it is adapted to stand the great heat to which it will be subjected. It should be made of a size and shape to enable it to be placed within the receptacle B, with preferably a space, J, around it. As the space J is to afford room into which the steam produced, as hereinafter described, may pass and from which it may be drawn, it is of small importance whether the space J be an annular one around the box or receiver A or a space provided above the box or in some other convenient way. A pipe, F, is carried from some proper source of water or steam supply through the cover D, so that water or steam may be introduced into the box or receiver A.

In the operation of my primary steam-generator I run a large quantity of molten slag into the box or receiver A, as may be desired. This may be done while the box is out of the receptacle B, or while it is in it, as may be most convenient. For lifting this box out and into the receptacle B, I provide it with ears *e*, to which a bail may be attached. The top D is then screwed down tightly into place. The space between the walls of the receptacle B will be understood as properly filled with water. A jet or current of wet steam or water, as may be desired, is then introduced through the pipe F into the box or receiver A. As soon as the water or steam, if steam at a low temperature be employed, is introduced into the box A, the molten slag will immediately heat it to a very high temperature. If water be employed, it will immediately convert it into steam. The steam will rush into the space J and be carried through the pipe G to the place where it is intended to be used. A number of boxes or receivers may be employed, one after the other and in different receptacles, if desired, so that a constant supply of steam at a very high temperature may be produced and carried to the place of use. If it is desired to use the steam thus produced for the generation of more steam, I employ a secondary generator. (Shown in Fig. 2 of the drawings.) This consists of a number of tubes, which open into a space between the heads K and L of the generator. These tubes are surrounded by water introduced from any proper source of water-supply. One way of introducing water, which will be found to be very beneficial, is to have a pipe, I, lead from the water-space between the walls of the receptacle B, so that as the water flows into such space through the pipe H it will become partially, if not highly, heated before it passes into the secondary generator to surround the tubes M and be converted into steam. The steam produced by the contact of the water with the molten slag in the box A will be carried by the pipe G into the space between the heads K and L, and preferably so as to enter the upper series of tubes in the secondary generator. It will enter the tubes and pass through them and back through the next series below and continue to pass back and forth through the tubes until it passes out at the pipe N. The course of the steam through the tubes M is sufficiently indicated by the arrows, and will be understood without further minute explanation. The steam passing from the primary generator and from direct contact with the molten slag will be of such a high temperature that as it passes through the tubes M it will heat the water surrounding them and convert it into steam, whence it may be drawn from the steam-dome and employed as steam produced in any other way can be employed.

It will be understood that the pipes F and G, which respectively lead into and out of the receptacle B, are provided with cocks or valves, so that they can be opened and closed and regulated at pleasure. The cover D is intended to fit closely upon the receptacle, and the receptacle is intended to be substantially steam-tight and capable of standing such interior pressure as may be required for the generation of steam. Whenever a jet of wet steam is introduced, it will be superheated, and whenever a jet or spray of water is introduced it will be converted into steam. In the claim I shall use the term "water" to signify water in its fluid or gaseous state. I shall speak of generating steam when I mean either producing steam from water or superheating wet steam.

I have described a secondary steam-generator, as I prefer to use steam produced in that way to the steam produced by the direct contact of the water with the molten slag. Such steam is liable to be found dirty and impregnated with various acids and other deleterious substances arising from the manner of its generation; but as my essential idea consists in the employment of hot or molten slag for the generation of steam I do not limit myself to the use of both a primary and a secondary generator. While I prefer to use them in that way, I reserve the right to use steam direct from the primary generator, if I so desire, without the employment of a secondary generator.

I have described the apparatus herein illustrated in connection with my process; but, as stated in the first part of this specification, I do not restrict myself to this device, as other means may be employed. My process should be distinguished from the previous use of metallic substances for this purpose, in which it is designed to repeatedly heat fragments of metal while in a closed chamber. Metal does not possess the property of being finely and rapidly disintegrated or broken by the action of water or steam, as is the case with heated or molten slag. It is this rapid exposure of

fresh heating-surfaces which renders slag the most desirable material for the direct generation of steam by this method.

What I regard as new, and desire to secure by Letters Patent, is—

The process of generating steam which consists in bringing water and heated slag in contact in a steam-tight receptacle, substantially as described.

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