

(No Model.)

3 Sheets—Sheet 1

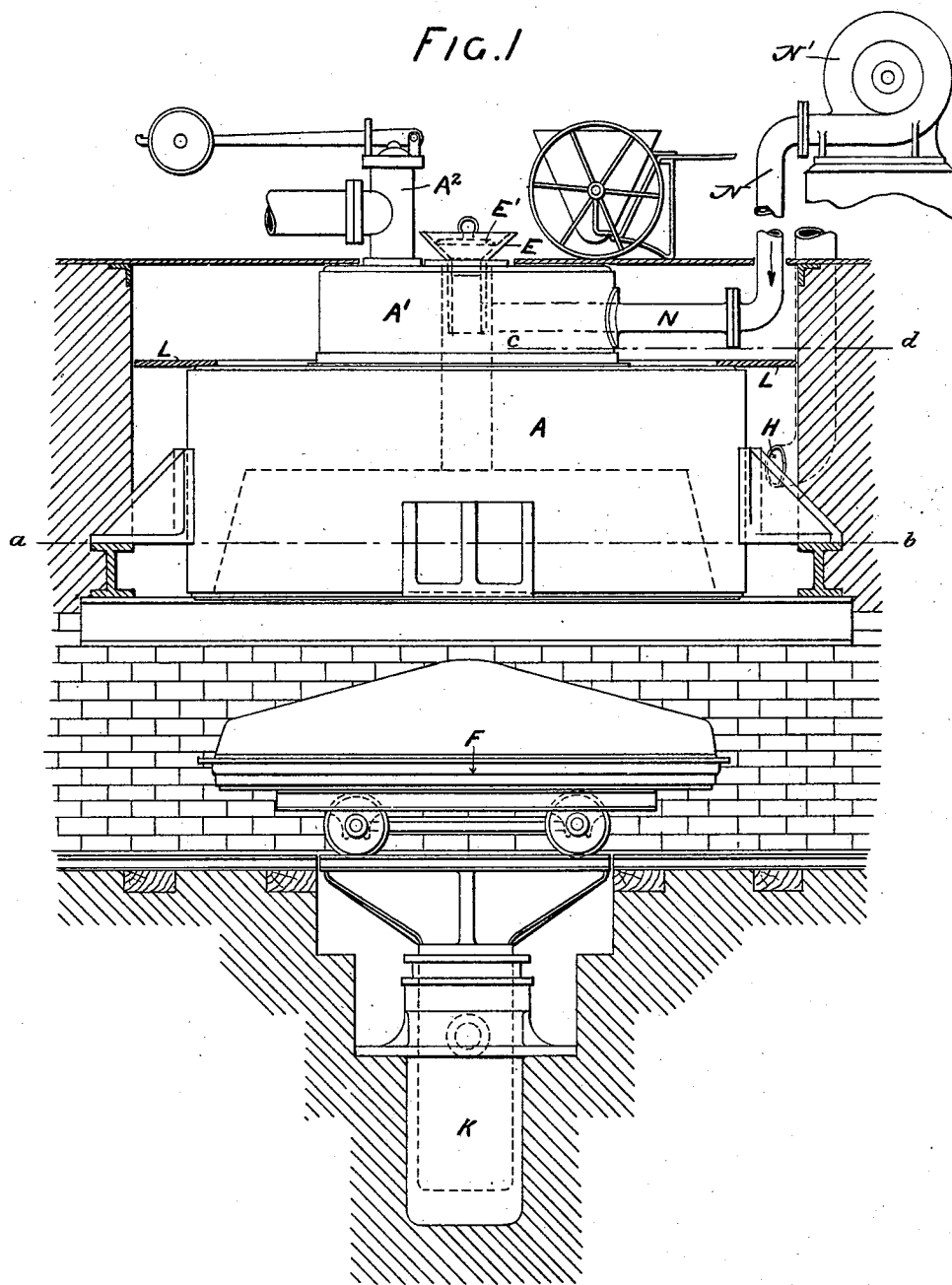
E. A. ASHCROFT.

METHOD OF AND APPARATUS FOR GENERATING STEAM.

No. 570,195.

Patented Oct. 27, 1896.

FIG. 1



WITNESSES.

Herbert H. Thorpe

J. W. Mansford

INVENTOR:

E. A. Ashcroft

BY

Mumford

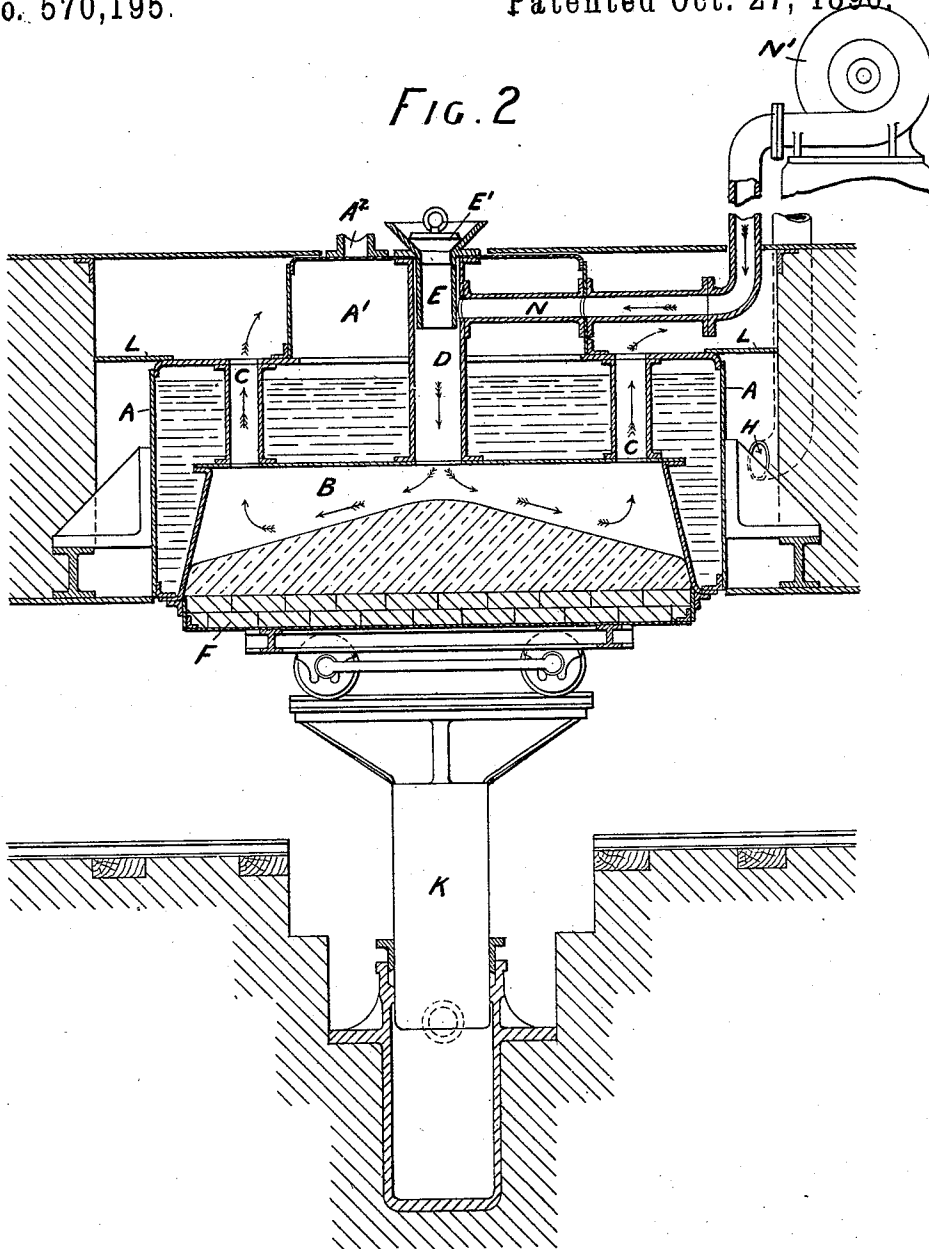
ATTORNEYS

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Herbert A. Thorpe
J. M. Haraford

INVENTOR:

E. A. Ashcroft.

BY

Mumford

ATTORNEYS

(No Model.)

3 Sheets—Sheet 3.

E. A. ASHCROFT.

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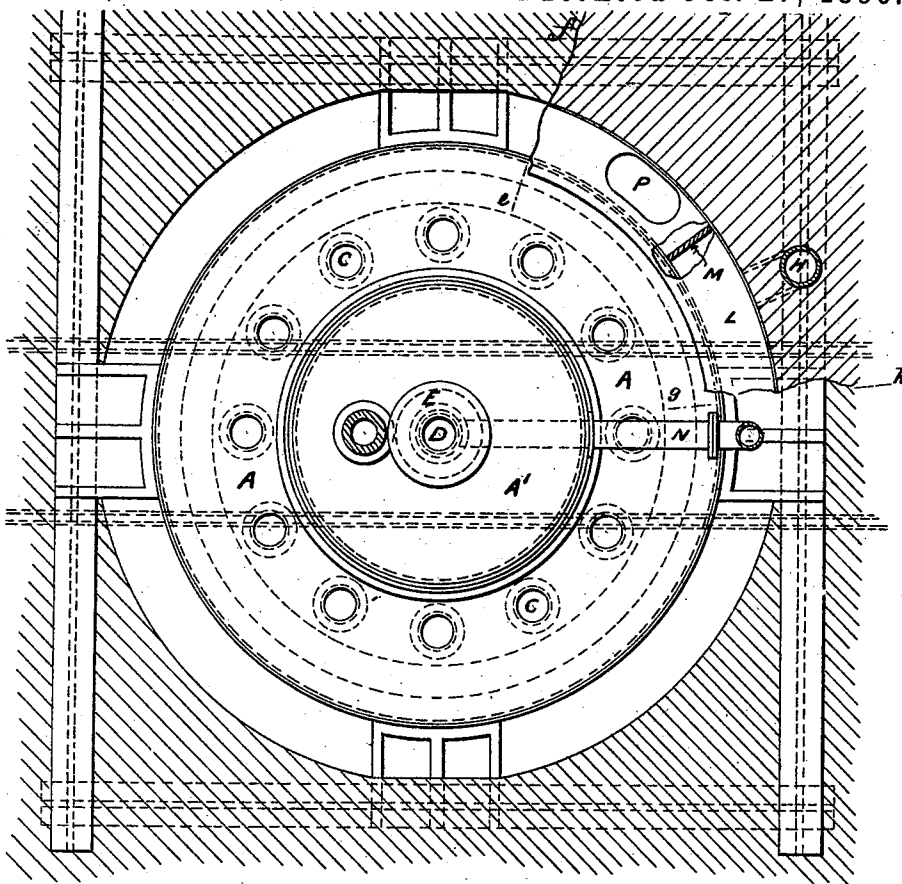
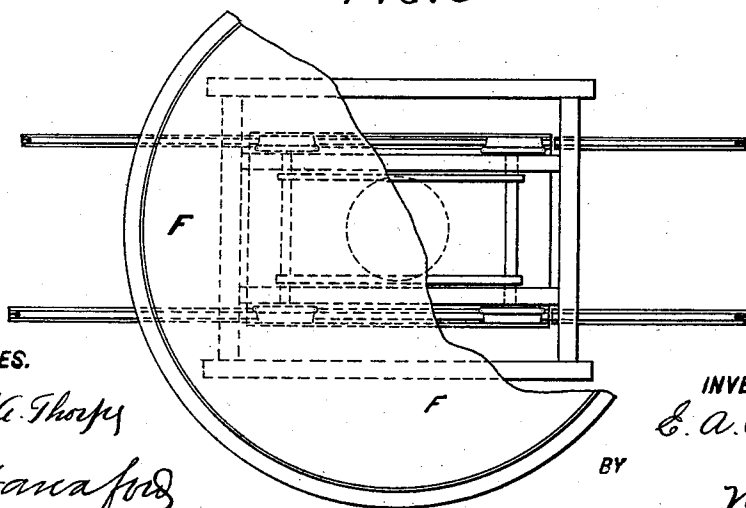


FIG. 3



WITNESSES.

Herbert K. Thorpe
J. M. Anderson

INVENTOR:

E. A. Ashcroft

BY

Mumford
ATTORNEYS

FIG. 4

UNITED STATES PATENT OFFICE.

EDGAR ARTHUR ASHCROFT, OF LONDON, ENGLAND.

METHOD OF AND APPARATUS FOR GENERATING STEAM.

SPECIFICATION forming part of Letters Patent No. 570,195, dated October 27, 1896.

Application filed December 27, 1895. Serial No. 573,545. (No model.) Patented in South Australia June 19, 1894, No. 2,707, and in New South Wales June 25, 1894, No. 5,126.

To all whom it may concern:

Be it known that I, EDGAR ARTHUR ASHCROFT, electrical engineer, of Willyama Works, Grays, London, in the county of Essex, England, have invented a new and useful Method of and Apparatus for Generating Steam, (for which I have obtained Letters Patent in the following countries, namely: South Australia, No. 2,707, dated June 19, 1894, and New South Wales, No. 5,126, dated June 25, 1894,) of which the following is a full, clear, and exact description.

This invention relates to an improved method of and apparatus for applying the heat of slag or other hot material coming from smelting or other furnaces to the purpose of generating steam.

The improved method consists, first, in supplying the heated slag or material to the heating-chamber of the boiler in such manner that the material will be spread out in a thin layer, so as by the continuous or intermittent accretion of material to present a constantly or frequently renewed heat-radiating surface of extended area. By this method of supplying the material in a succession of superposed thin layers the heat of each layer is radiated and utilized as the layer is deposited on the already-cooled subjacent layers, so that the superjacent layer is always the hottest, the method being distinguishable in this respect from the cooling downward from the surface of a mass of considerable depth, of which the internal portions, owing to the poor heat-conducting quality of the material, will retain their heat long after the surface portion has become cooled.

The method consists, secondly, in assisting the convection of the heat from the exposed surface of the hot material to the heating-surface of the boiler by means of a current of air passing over the surface of the hot material, then over the heating-surface of the boiler, and then over a freshly-renewed surface of the hot material, and so on, in a continuous cycle.

The improved apparatus for carrying this method into effect is illustrated in the accompanying drawings, forming part of this specification, wherein—

Figure 1 is a side elevation of the boiler,

the setting being in section and the hearth in the lowered position. Fig. 2 is a vertical section of the same, the hearth being in the raised or operative position. Fig. 3 is a plan of the boiler, the setting being in section, mainly on line *a b*, Fig. 1, and partly (that is to say, between the lines *e f* and *g h*) in section on line *c d*, Fig. 1. Fig. 4 is a plan of the hearth, partly broken away to show its supporting-trolley.

The same letters of reference denote like parts in all the figures.

Referring to Figs. 1 to 4, the boiler comprises the outer shell *A A'* and internal heating-chamber *B*, which resembles the fire-box of an ordinary vertical boiler, except that it has no fire-grate and is closed at bottom by the hearth, this chamber being of circular form in plan and of slightly conical form. The steam-dome *A'* is of lesser diameter than the main body *A*, which is traversed by a number of vertical flues *C*, leading from the heating-chamber *B* to the space around the steam-dome *A'*. A central tube *D* leads through the steam-dome to the heating-chamber, through which the hot material is supplied to the hearth, and air is conveyed to the heating-chamber *B* to quickly convey the heat of the material to the heating-surface of the boiler, the material being dumped or otherwise supplied through the tube *D* and funnel *E*, which may be sealed against the escape of air by a stopper or plug *E'* whenever the condition of the operation makes this desirable. From the dome *A'* extends a valve-controlled outlet-pipe *A²*.

The boiler is inclosed in an annular flue-space within a brickwork setting, this flue-space being closed at top and bottom and divided by a horizontal plate *L* at about the level of the top of the body *A*, the flue above this division-plate being referred to as the "upper" flue and the space below it as the "lower" or "outer" flue. The latter has a vertical partition *M*, Fig. 3, at one side of which the top and bottom flues communicate by an aperture *P* in the horizontal division *L*, while at the other side a pipe *H* connects the lower part of the outer flue to the casing of a fan, of which the delivery-pipe *N* is connected to the central tube *D*, whereby a con-

tinuous circulation of heated air through the boiler is produced.

The boiler may be supported by brackets on pairs of longitudinal and cross girders, the latter resting on the former and bridging over a tunnel beneath. The hearth is adapted to close the bottom of the heating-chamber and is constructed of non-conducting material, such as fire-brick, held in a metal tray F of circular form, carried by a trolley, on which the material when cooled can be conveyed away. The tray F has an external flange adapted to abut against the bottom of the boiler-shell A when the hearth is raised to its operative position, so as to close the heating-chamber B, the raising and lowering of the hearth being performed by means of a hydraulic ram K, carrying a section of the track upon which the trolley runs. The axles of the trolley-wheels are coupled together by side bars, and the body of the trolley is adapted to pivot about one of the axles when its other end is lifted off the other axle for discharging the cooled material from the hearth.

The operation is as follows: The hearth being in its raised position, the slag or other hot material from the furnace is poured through the central tube D and becomes spread out on the hearth in a thin layer which radiates heat and is continuously or intermittently renewed, the slight central superelevation of the material exposing a greater area and disposing it to greater advantage. To assist the transference of the heat to the boiler, a continuous circulation of air is maintained by the fan N', the air being delivered through the pipe N and central tube D, becoming heated in passing over the material on the hearth, then passing up through the flues C into the upper flue, through the aperture P into the outer flue, and around the body A of the boiler to the tube II, by which it is returned to the fan after having been thus brought into contact with a very extended heating-surface. When the heating-chamber is nearly filled, the hearth is lowered by means of the ram K, wheeled away on its trolley, and the heated exhausted material discharged, the hearth being then returned and raised into position again or another one being brought into use in its place.

The generation of steam will depend jointly on the rate at which hot material is supplied and at which the air is circulated, and it will be seen that by a rapid circulation of air, as above described, the rate of generation may be very rapid.

I claim—

1. The herein-described method of heating a steam-boiler by molten slag or other hot material coming from a blast or other furnace, the said method consisting essentially in spreading the slag in thin superimposed layers on a hearth within the heating-chamber of the boiler, and at same time causing a current of air to circulate over the freshly-deposited layer of hot material, then in contact with the

heating-surfaces of the boiler, then back over the hot material, and so on in a continuous cycle, as specified.

2. A steam-boiler adapted to be heated by hot or molten material having an internal heating-chamber closed at bottom by a removable hearth, a central supply-pipe and flues leading up from the heating-chamber through the water-space of the boiler to a flue-space above, as specified.

3. A steam-boiler adapted to be heated by hot or molten material, and having an internal heating-chamber closed at bottom by a removable hearth, a central supply-pipe, flues leading up from the heating-chamber through the water-space of the boiler to a flue-space above, the said flue communicating with, a lower or outer flue around the boiler-shell, divided by a partition and communicating with an exhaust-pipe, as specified.

4. The combination, with a boiler having an internal heating-chamber closed by a removable hearth, a central supply-pipe, and flues leading up from the heating-chamber through the water-space of the boiler to flues above and around the boiler-shell, of a fan and air-circulation pipes respectively connected with the central supply-pipe and the said outer flue whereby a continuous circulation of air is maintained in a cycle over the freshly-deposited layers of hot material and in contact with the heating-surfaces of the boiler, as specified.

5. An apparatus for utilizing slag, the apparatus having a track and a stationary setting above the track, a boiler-shell arranged in the setting and having a downwardly-opening heating-chamber and also having air-circulating flues, a table capable of moving on the track and of elevating slag to the heating-chamber of the boiler, and means comprising part of the track by which the table may be raised, substantially as described.

6. An apparatus for utilizing slag, the apparatus having a track and a setting arranged above the track, a boiler-shell held within the setting and having a downwardly-opening heating-chamber, a table mounted to move on the track, and means for raising the table into the heating-chamber, substantially as described.

7. An apparatus for utilizing slag, having a track and a setting stationary above the track, a boiler-shell held within the setting and having a downwardly-opening heating-chamber, air-circulating flues communicating with the heating-chamber, a table mounted to roll on the track, and means for raising the table to the heating-chamber, substantially as described.

8. An apparatus for utilizing slag, having a track and a stationary setting above the track, the setting having a hollow space closed at its top, a boiler-shell supported within the space and having a heating-chamber, the boiler being of a size less than that of the said space and thus forming a chamber at the side

and top of the shell, a plate projecting outwardly from the upper portion of the shell and forming the said chamber into two divisions having communication by an orifice in the plate and the lower division having an outlet, a partition-plate in the lower division, an air-inlet flue passing into the heating-chamber, and a second air-flue passing from the heating-chamber to the upper division of the chamber in the setting, substantially as described.

9. An apparatus for utilizing slag, having a track and a setting above the track, the setting having a hollow space closed at its top, a boiler-shell held within the space and of a size decreased over that of the space so as to form a chamber at the sides of the top of the boiler-shell and the boiler-shell having a downwardly-opening heating-chamber, a mounted table capable of moving upwardly to close the lower end of the heating-chamber, a plate extending outwardly from the upper portion of the boiler-shell to form the said chamber into two divisions having communication by an opening in the plate, a partition-plate in the lower division and said lower division having an outlet-orifice, an air-inlet flue extending into the heating-chamber, and a second air-flue extending from the heating-chamber through the boiler and to the upper division, substantially as described.

10. An apparatus for utilizing slag, having

a track, a table mounted to move on said track, means forming a portion of the track and on which means the table may pass to be raised from the track, and a boiler held above said means and having a downwardly-opening heating-chamber to which the table may move, substantially as described.

11. An apparatus for utilizing slag, having a setting with a hollow space, a covering-plate closing the upper side of the said space, a boiler-shell smaller than the said space and supported within the space, the boiler thus leaving a chamber within the hollow space and the boiler having a heating-chamber, a slag-feed tube passing through the said plate at the upper side of the hollow space in the setting and through the boiler to communicate with the heating-chamber thereof, an air-inlet tube passing into the chamber between the boiler and the setting and communicating with the slag-feed tube, and an air-outlet tube passing from the heating-chamber through the boiler and communicating with the space between the boiler and the setting, such space having an outlet-orifice, substantially as described.

Signed by me, the said EDGAR ARTHUR ASHCROFT, in the presence of two witnesses.

EDGAR ARTHUR ASHCROFT.

Witnesses:

JOSEPH LAKE,

T. J. OSMAN.