

No. 711,289.

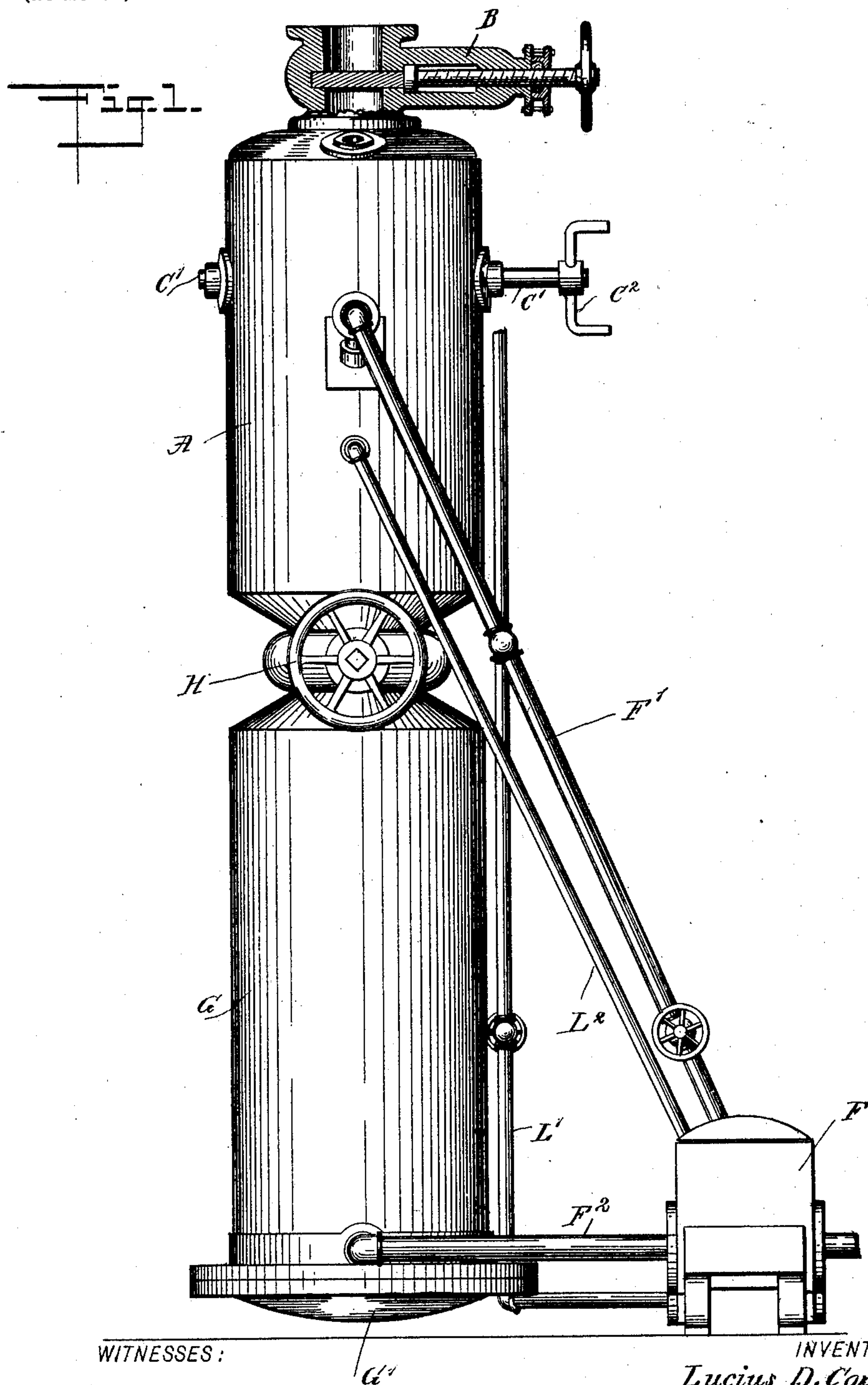
Patented Oct. 14, 1902.

L. D. COPELAND.  
APPARATUS FOR GENERATING MOTIVE POWER.

(Application filed Oct. 11, 1901.)

(No Model.)

2 Sheets—Sheet 1.



WITNESSES:

*A. Russell Bond.*  
*Rev. J. H. Foster.*

INVENTOR

*Lucius D. Copeland*

BY

*Murray*

ATTORNEYS

No. 711,289.

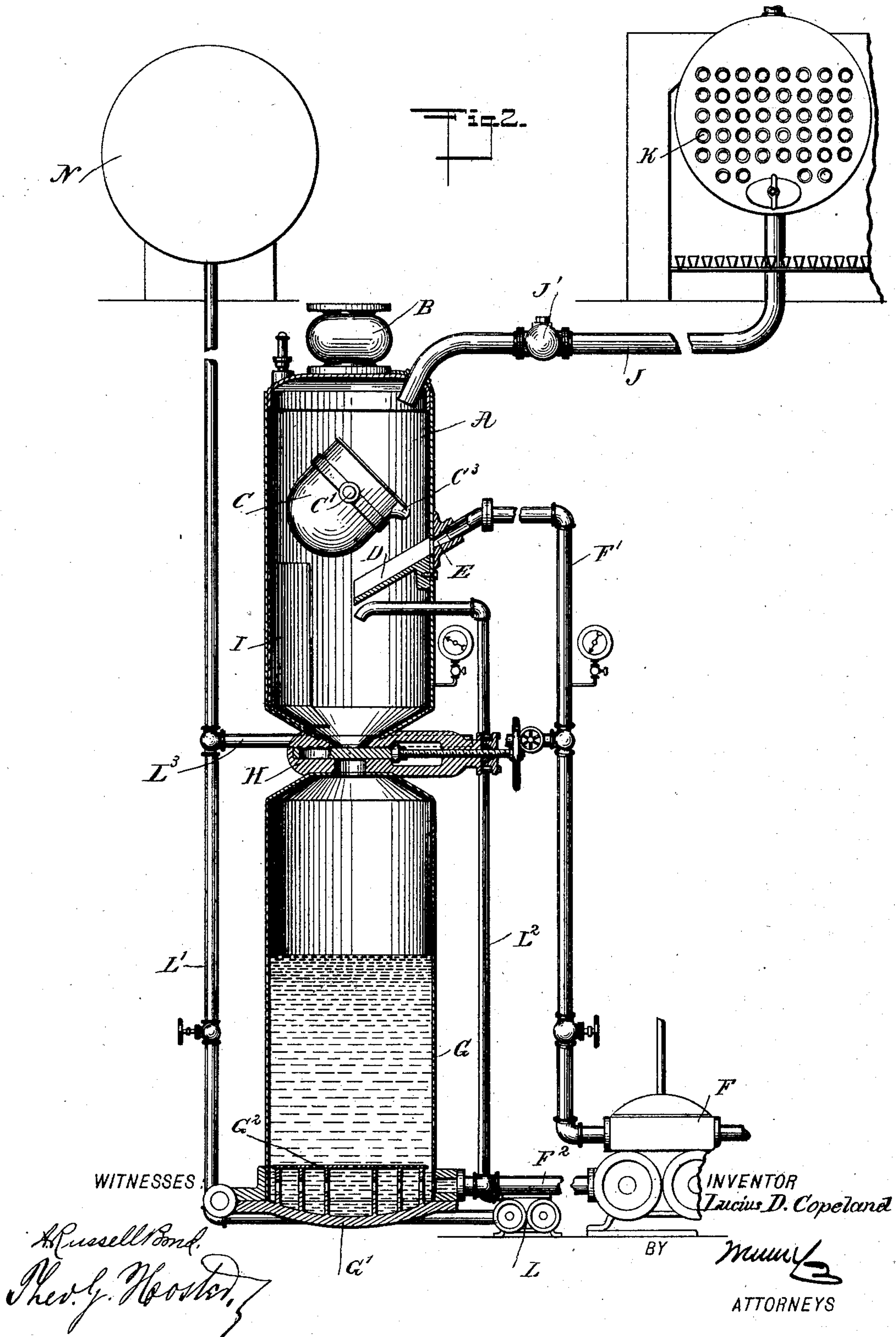
Patented Oct. 14, 1902.

L. D. COPELAND.  
APPARATUS FOR GENERATING MOTIVE POWER.

(Application filed Oct. 11, 1901.)

(No Model.)

2 Sheets—Sheet 2.





# UNITED STATES PATENT OFFICE.

LUCIUS DAY COPELAND, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-HALF TO GEORGE MITCHELL, OF LOS ANGELES, CALIFORNIA.

## APPARATUS FOR GENERATING MOTIVE POWER.

SPECIFICATION forming part of Letters Patent No. 711,289, dated October 14, 1902.

Application filed October 11, 1901. Serial No. 78,321. (No model.)

*To all whom it may concern:*

Be it known that I, LUCIUS DAY COPELAND, a citizen of the United States, and a resident of Los Angeles, in the county of Los Angeles and State of California, have invented a new and Improved Steam-Generator, of which the following is a full, clear, and exact description.

The object of the invention is to provide certain new and useful improvements in apparatus for generating steam by bringing water in contact with molten or hot furnace-slag.

The invention consists of novel features and parts and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of the improved apparatus, the feed-valve being shown in section; and Fig. 2 is a reduced transverse section of the same as applied.

The improved apparatus consists, essentially, of a generator A, provided on its top with a feed-valve B for periodically introducing the molten or hot slag from the furnace to the interior of the generator A, the feed-valve directing the molten slag into a ladle C, having trunnions C' journaled in the sides of the generator A, one of the trunnions being provided at its outer end with a suitable handle C<sup>2</sup>, adapted to be taken hold of by the operator for turning the ladle so as to pour the molten slag through the spout C<sup>3</sup> thereof into a chute D, extending downwardly from one side of the generator A, as plainly indicated in Fig. 2. The upper end of the chute D is connected with a nozzle E, into which opens the discharge-pipe F' of a circulating-pump F, having its suction-pipe F<sup>2</sup> connected with the lower end of a separating-chamber G, connected at the upper end by a slide-valve H with the lower end of the generator A.

It is evident that when the molten slag is poured out of the ladle C into the chute D and a stream of water is forced by the circulating-pump F through the pipe F' and nozzle E down onto the stream of molten slag

then the water is heated by coming in contact with the molten slag, and consequently steam is generated within the generator A. The action of the water on the molten slag not only forces the slag down the chute D, but it also divides and hardens it to granular form, the divided slag and water passing onto a deflecting and wear plate I, arranged within the generator A, as is plainly indicated in Fig. 2. The generator A may be lined at the inside with removable plates to protect the shell of the casing, and the said plates can be readily removed and replaced by new ones when worn out. When the valve H is open, the granular slag and the water pass down into the separating-chamber G, which is provided with a drop-bottom G', supporting a perforated false bottom G<sup>2</sup>, on which accumulates the granular slag. The suction-pipe F<sup>2</sup> of the circulating-pump F opens into the chamber G below the said false bottom G<sup>2</sup>, so that the water is withdrawn from the separating-chamber by the feed-pump and returned to the chute D to be again forced into contact with the molten slag in the manner above described. The granular slag accumulating on the false bottom G<sup>2</sup> is removed from time to time by opening the drop-bottom G' and removing the slag from the false bottom G<sup>2</sup>. This is usually done at the time the valve H is closed. The steam generated in the generator A is carried by a pipe J to a boiler, receiver, or other receptacle K to be absorbed by water contained therein to raise the temperature thereof and generate steam, which is carried to engines or other machinery for use as a motive agent. It is understood that only a portion of the water forced by the circulating-pump F into the generator A is changed into steam carried by the pipe J, and in order to make up for the water thus lost a small feed-pump L is provided, having its suction-pipe L' connected with a suitable source of water-supply N. The discharge-pipe L<sup>2</sup> of the pump L opens into the generator A, preferably under the chute D, so that the water is heated while passing from the generator A and chamber G to the feed-pump F. The pipe J, previously mentioned, is provided with a suitable check-valve J', and the pipes F' and L' are provided with suitable valves for closing the



pipes whenever it is desired to do so. A valved branch pipe L<sup>3</sup> connects the pipe L' with the pipe F' to permit of pumping the water from the chamber G back into the water-supply N by the pump F whenever it is desired to do so. It is understood that when the apparatus is in use the valve B is only opened while filling the ladle C with molten slag, and after this has been done the valve B is closed, and then the ladle C is turned by the operator turning the handle C<sup>2</sup> in the proper direction to cause the ladle to discharge the molten slag in a thin stream into the chute D. It is understood that the valve H is closed during the time the feed-valve B is open to fill the ladle C.

From the foregoing it is evident that the molten slag heretofore thrown away and wasted is utilized to generate steam in the manner described, it being expressly understood that the water coming in contact with the molten slag is readily changed into steam by the heat emanating from the molten slag.

From the foregoing description of my improved apparatus and its method of operation it will be observed that by feeding the molten slag into the generator-casing and in direct contact with water contained therein the heat contained in the slag is quickly absorbed by the water in the generator, owing to the granulation of the slag, which insures the direct contact of water with the surfaces of the divided slag, and by this method of operation the heat of the slag is not only quickly extracted, but the molten slag is transformed into a condition in which it may be readily handled and used.

I do not limit myself to the peculiar manner of using the slag as described, as it may be differently utilized to accomplish the same object. For instance, the molten or hot slag may be poured into a bath of water confined in a closed vessel.

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

1. An apparatus for utilizing molten slag for generating steam, comprising a closed generator having a slag-feed device, a slag-receiving receptacle in the said generator and adapted to receive the molten slag from the said feed device, means for emptying the slag from the receiving-receptacle after the feed device is closed, and means for forcing water in contact with the slag as the latter is discharged from the said receiving-receptacle, as set forth.

2. An apparatus for utilizing molten slag for generating steam, comprising a closed generator, a water-supply for the same, a feed device for the molten slag, a slag-receiving receptacle in the said generator, means for emptying the receiving-receptacle of its contents, and means for dividing the molten slag as it is discharged from the said receiving-receptacle, as set forth.

3. An apparatus for utilizing molten slag

for generating steam, comprising a closed generator, means for pouring the molten slag in the generator, a circulating-pump having its discharge-pipe connected with the said generator, for discharging water in the generator to meet the running or flowing stream of molten slag, and a separating-chamber in communication with the said generator for receiving the slag and water, the said separating-chamber being connected with the suction-pipe of the said circulating-pump, as set forth.

4. An apparatus for utilizing molten slag for generating steam, comprising a closed generator, a ladle within the said generator for receiving and pouring the molten slag, and means for forcing a stream of water into the stream of molten slag poured by the said ladle, as set forth.

5. An apparatus for utilizing molten slag for generating steam, comprising a closed generator, a ladle within the said generator, means for turning the said ladle from the outside of the generator, a chute within the generator and into which the molten slag is poured from the said ladle, and means for directing a stream of water onto the said chute, as set forth.

6. An apparatus for utilizing molten slag for generating steam, comprising a closed generator, a separating-chamber having a valved connection with the said generator, a ladle mounted to turn within the said generator, means for turning the ladle from the outside of the generator, a chute within the generator and arranged to receive the molten slag from the ladle, and a circulating-pump having a discharge-pipe for discharging the water onto the said chute, the suction-pipe of the said circulating-pump being connected with the bottom of the said separating-chamber, as set forth.

7. An apparatus for utilizing molten slag for generating steam, comprising a closed generator, a separating-chamber having a valved connection with the said generator, a ladle mounted to turn within the said generator, means for turning the ladle from the outside of the generator, a chute within the generator and arranged to receive the molten slag from the ladle, a circulating-pump having a discharge-pipe for discharging the water onto the said chute, the suction-pipe of the said circulating-pump being connected with the bottom of the said separating-chamber, and means in the said separating-chamber for separating the water from the granular slag, as set forth.

8. An apparatus for utilizing molten slag for generating steam, comprising a generator, a separating-chamber having a valved connection with the said generator, a feed device on the generator for the molten slag, a receiving-receptacle in the said generator, means for introducing water into the generator, means for emptying the receiving-receptacle of its contents, and means for divid-



ing the slag as it leaves the receiving-receptacle, as set forth.

9. An apparatus for utilizing molten slag for generating steam, comprising a closed generator in which the molten slag is subjected to the action of water to generate steam, a separating-chamber, and a valved connection between the said generator and the said separating-chamber to empty the slag and water from the generator into the separating-chamber, as set forth.

10. An apparatus for utilizing molten slag for generating steam, comprising a closed generator in which the molten slag is subjected to the action of water to generate steam, a closed separating-chamber, and a valved connection between the said generator and the said separating-chamber, the said separating-chamber being located below the said generator, to cause the water and slag to flow by their own gravity from the generator into the separating-chamber on opening the said valved connection, as set forth.

11. An apparatus for utilizing molten slag for generating steam, provided with a generator, a slag-receptacle therein, a water-supply for the said generator, means for emptying the receptacle of its contents, and means for dividing the slag as it is emptied from the said receptacle, as set forth.

12. A slag steam-generator having a generator-casing, a slag-receiving receptacle within the generator, and means for emptying the contents of the receiving-receptacle into the generator-casing, as set forth.

13. A slag steam-generator having a generator-casing, a slag-receiving receptacle within the generator, means for emptying the receiving-receptacle of the slag, and means within the generator and below the receptacle for the slag to strike against on leaving the receptacle, to break up or divide the slag, as set forth.

14. A slag steam-generator having a dividing device within the generator, to divide or break up the slag in the generator, as set forth.

15. An apparatus for utilizing molten or heated slag for generating steam, comprising a closed generator having a slag-feed device, a slag-receiving receptacle adapted to receive the molten or heated slag from said feed device, and means for emptying the slag from the receiving-receptacle into contact with water in the generator, as set forth.

16. An apparatus for utilizing molten or heated slag for generating steam, comprising a closed generator having a slag-feeding device, a slag-receiving receptacle within the generator and adapted to receive the molten or heated slag from the said feed device, and means for emptying the slag from the receiving-receptacle into contact with water in the generator, as set forth.

17. In an apparatus for generating steam from molten or heated slag, the combination with a steam-generator, and means for closing it steam-tight, of means for feeding mol-

ten or heated slag into water in the generator, a steam-receptacle, a pipe for conveying steam from the generator into the steam-receptacle, and a check-valve in said pipe, substantially as set forth.

18. In an apparatus for generating steam from molten or heated slag, the combination with a steam-generator provided with slag feed and discharge openings, and valves for closing said openings steam-tight, of means for feeding charges of molten or heated slag into the generator and in contact with water contained therein, substantially as set forth.

19. In an apparatus for generating steam from molten slag, the combination with a steam-generator provided with slag feeding and discharge openings and valves for closing said openings steam-tight, of a chamber connected with the lower end of said generator, and means for opening and closing the lower end of said chamber, substantially as set forth.

20. The combination with a steam-generator constructed with a converging or funnel-shaped lower end, of means for feeding heated slag through the upper end of the generator directly into the water contained therein, and means connected with the lower and converging end of the generator for discharging the granulated slag therefrom, substantially as set forth.

21. In a slag steam-generator, the combination with a steam-generator, and means for regulating and controlling the feeding of slag into the steam-generator, of a collecting-chamber located below the steam-generator and connecting therewith, a valve located between the collecting-chamber and steam-generator, and means for regulating the discharge of slag from the collecting-chamber, substantially as set forth.

22. In a slag steam-generator, the combination with a steam-generator, and means for regulating the feeding of slag by its gravity into the upper portion of said generator, of a collecting-chamber communicating with the lower end of the steam-generator, and a pipe for conveying water or steam from the collecting-chamber to any desired point for use, substantially as set forth.

23. In a slag steam-generator, the combination with a steam-generating chamber, of a slag-feeding and valve-controlled device for causing charges of hot slag to be fed by gravity into the steam-generating chamber, and a discharge-conduit chamber and valves for causing charges of granulated slag to be discharged by gravity, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two witnesses.

LUCIUS DAY COPELAND.

Witnesses:

D. H. JOHNSTON,  
W. C. READ.