No. 832,895. PATENTED OCT. 9, 1906.

H. L. CHARLES.

METHOD OF LINING CONVERTERS.

APPLICATION FILED NOV. 21, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

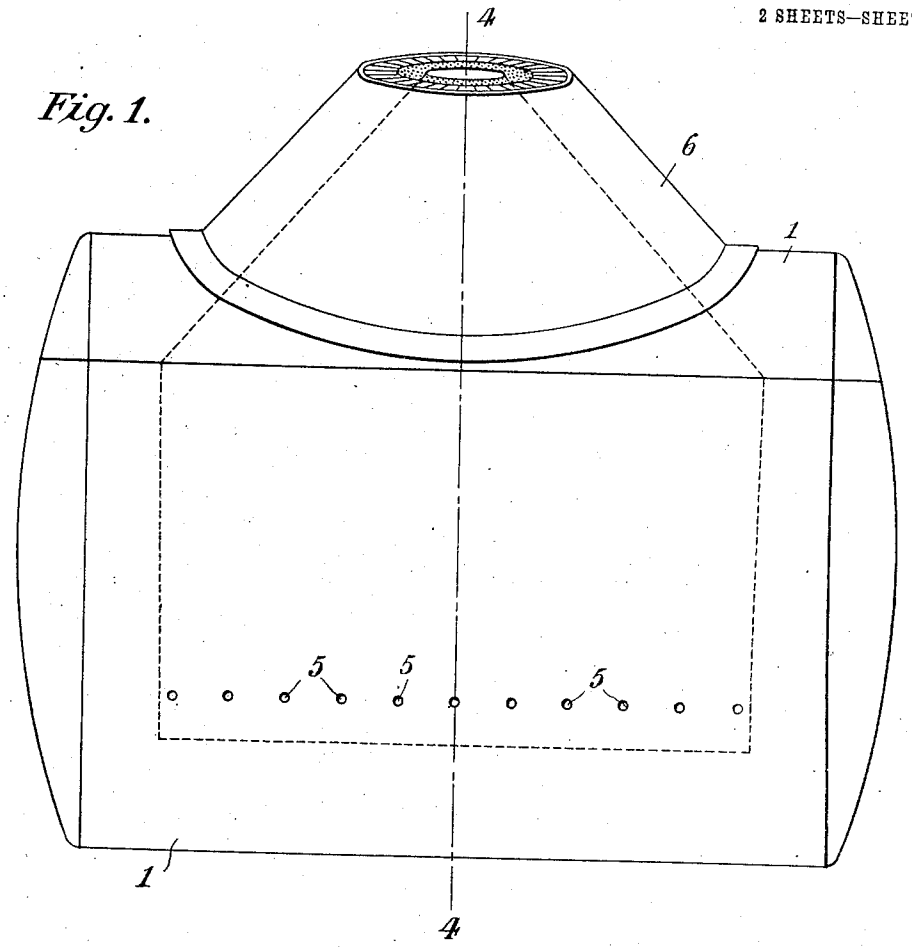
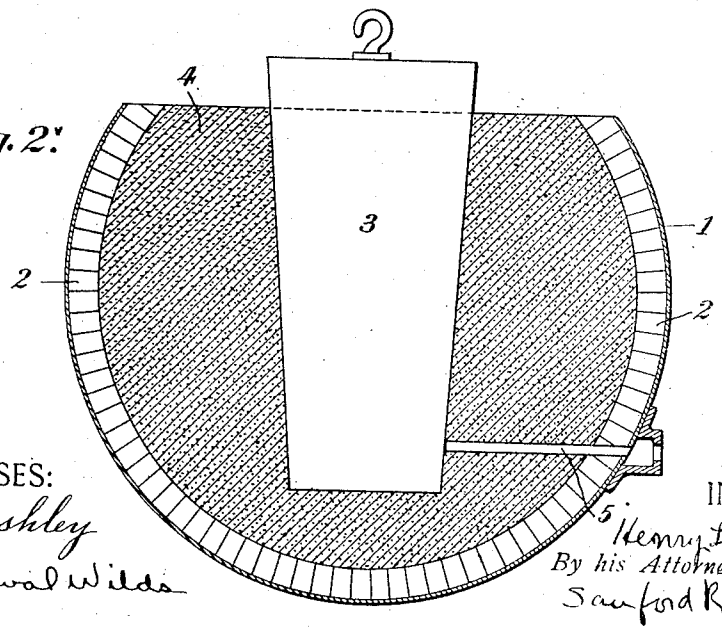


Fig. 2.



WITNESSES:

C. E. Ashley

Percival Wilds

INVENTOR

Henry Lewis Charles

By his Attorney,

Sanford Robinson

No. 832,895. PATENTED OCT. 9, 1906.

H. L. CHARLES.

METHOD OF LINING CONVERTERS.

APPLICATION FILED NOV. 21, 1905.

2 SHEETS—SHEET 2.

Fig. 3.

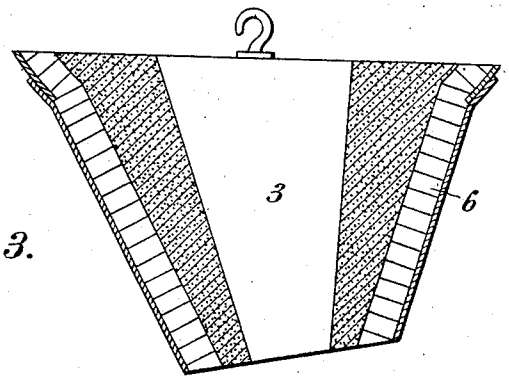
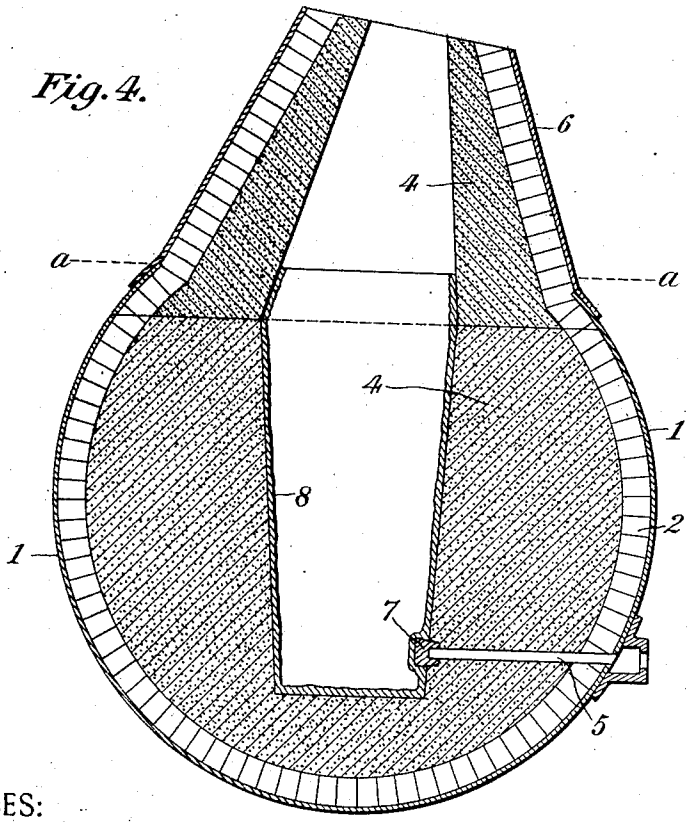


Fig. 4.



WITNESSES:

C. E. Ashley

Percival Wilde.

INVENTOR

Henry Lewis Charles

By his Attorney,

Sanford Robinson

UNITED STATES PATENT OFFICE.

HENRY L. CHARLES, OF BUTTE, MONTANA, ASSIGNOR OF ONE-HALF TO F. AUG. HEINZE, OF BUTTE, MONTANA.

METHOD OF LINING CONVERTERS.

No. 832,895. Specification of Letters Patent. Patented Oct. 9, 1906.

Application filed November 21, 1905. Serial No. 288,426.

To all whom it may concern:

Be it known that I, HENRY LEWIS CHARLES, a citizen of the United States of America, residing at Butte, Silverbow county, State of Montana, have invented certain new and useful Improvements in Methods of Lining Converters, of which the following is a specification.

My invention relates to improvements in the method of lining converters or furnaces for converting or refining copper or other fusible ores, and is intended, primarily, to provide an improved method of drying and hardening the basic or silicious lining of such converter or furnace where the lining material, consisting, usually, of silica or silicious ores mixed with clay and water, is tamped around the outer shell of the converter or furnace and then requires to be thoroughly dried out before the converter or furnace can be used.

My invention will be best understood by reference to the two sheets of drawings forming part of this specification, in which—

Figure 1 is a side elevation of a converter of ordinary form, showing by dotted lines the position of the inner cores when inserted in the converter for the purposes of tamping the lining. Fig. 2 is a cross-section of the body or lower half of the converter, showing the inner core in position and the lining tamped in. Fig. 3 is a similar cross-section of the removable cap of the converter; and Fig. 4 is a cross-section of the converter on the lines 4 4 of Fig. 1, showing the same after the removal of the cores and the formation of an inner shell on the lining in the manner hereinafter indicated.

Only such parts of an ordinary converter are shown as will illustrate the invention.

The method now commonly used for lining converters of the type to which my invention applies is as follows, reference being made to the accompanying drawings: The bowl or outer shell of the converter 1, which is usually made of heavy boiler-plate, is first lined with a four-inch layer of fire-brick 2 and an inner core 3 inserted. Lining material 4, consisting of silica or silicious ores, with just enough plastic clay or suitable binder mixed with water in a pan or Chilian mill, is then tamped around the inner core by pneumatic rammers and the core removed and the cap put in place. This lining must now be dried out before the converter can be used, and it is to this part of the process to which my invention chiefly relates. The present general manner of accomplishing this result is as follows: The converter is filled with wood and a fire started. A light blast is then used through the twyers 5 to get the wood burning freely. Then about two hundred and fifty pounds of coke is put in and more blast turned on to get as high heat inside the lining as possible. This amount of coke is required to be put in three or four times in twenty-four hours to accomplish sufficient drying of the lining, so that the converter may be used. Under this method, however, it is impossible to completely dry a wet lining in the twenty-four hours usually consumed for this process unless at least two tons of coke are used in each converter, and it is doubtful if it would be thoroughly dried even then. As a consequence this process not only requires a large amount of time and expense of fuel, but also produces a very imperfectly-dried lining. Any remaining moisture in the lining is dried after corrosion has taken place, while the converter is in operation. It is no uncommon thing to see steam oozing out of the twyers and joints when the lining is making its last run. In other words, when the lining has been corroded within a few inches of the brick moisture is still visible. Not only this, but very uneven drying is he result. It is quite evident when the blast is blown in through the twyers 5 at the bottom the heat will be nearly all driven up to the cap or top of the converter and away from the twyers and the extreme bottom, where it is most essential that good drying be done, and quite frequently owing to poor drying large pieces of lining at the twyers are blown out as soon as fast corrosion takes place. This is caused by steam-pressure between the lining and shell of the converter and by not having proper vent-holes in the shell for the steam to escape.

I have discovered that a complete drying of the lining and total expulsion of the moisture can be accomplished in far less time than is now required for the partial and incomplete drying secured by the method outlined above now in use by the use of heat from

molten materials, giving not only uniformity of drying, but a total saving in cost of fuel and power, highest possible efficiency in lining, faster running by even corrosion, and no caving down of lining and less converters required, as each one can be lined and dried and put back in use in eight hours.

My method of procedure is as follows: After the tamping of the lining material 2 in the manner hereinbefore indicated and the removal of the cores 3 from the body and the cap, which are tamped separately, the cap 6 is fastened in its place upon the body of the converter, as shown in Fig. 4. The twyers 5 are than closed or plugged with small balls or fingers of clay 7 to keep the molten material from filling them, and the process of drying the lining is then begun. Molten slag, low-grade copper, or iron mattes from converters, reverberatory furnaces, or any other furnace can be used. Where matte is used it will retain its heat much longer by having it low in copper and high in iron. Converter-slag is preferred, as it has a higher temperature than all other known slags. Blast-furnace matte comes next, as it also has a high temperature when low in copper and high in iron; but any other slags or mattes can be used, but require closer attention, as they are not so hot. The converter is first filled with this molten slag or matte up to the lines *a a*, Fig. 4. A few pieces of wood or coal are then put on top of the slag or matte and a light fire kindled to keep it from chilling. In about one hour a shell of slag or matte 8, Fig. 4, will be formed all around inside of the lining up to the lines *a a*. The first slag or matte is then poured off and a fresh hot ladle of slag or matte is poured into the converter. This can remain indefinitely, as the heat from the first slag or matte penetrates the lining so far that the remaining moisture will be totally driven out in three hours and the lining remain hot for two hours. The number of times fresh molten material is necessary will depend on the thickness of the lining used. A number of vent-holes are provided in the body of the converter to allow the steam driven out to escape. As a result of this method of drying the lining in a very brief period of time compared with the present process, a complete and uniform hardening of the lining is secured, reducing the cost to the minimum and allowing of even corrosion which cannot be had without complete expulsion of moisture from the lining. In addition, the slag shell formed on the inside is easier smelted than the cold hard silica lining, making the converter run faster and raise heat quicker than is possible in the old way. The resulting slag from first corrosion will run higher in iron than under the old process.

I claim as my invention—

1. The within-described method of drying and hardening the basic or silicious lining of converters or refining-furnaces prior to their use in oxidation by using the heat derived from the introduction of molten material within the converter or refining-furnace while the basic or silicious lining is still in a damp and unhardened condition.

2. The within-described method of drying and hardening the basic or silicious lining of converters or refining-furnaces prior to their use in oxidation by using the heat derived from the introduction of molten material within the converter or refining-furnace while the basic or silicious lining is still in a damp and unhardened condition to form a shell over the inner surface of the lining.

3. The within-described method of drying and hardening the basic or silicious lining of converters or refining-furnaces by introducing molten slag or matte within the converter or refining-furnace while the basic or silicious lining is still in a damp and unhardened condition.

4. The within-described method of drying and hardening the basic or silicious lining of converters or refining-furnaces by introducing molten slag or matte within the converter or refining-furnace while the basic or silicious lining is still in a damp and unhardened condition to form a slag or matte shell over the inner surface of the lining material.

5. The within-described method of lining converters or refining-furnaces consisting of first tamping the lining material around an inner core, then removing the core, and while the lining material is still damp and unhardened introducing molten material within the converter or refining-furnace in sufficent quantities to completely dry and harden the lining material.

6. The within-described method of lining converters or refining-furnaces consisting of first tamping the lining material around an inner core, then removing the core, and while the lining material is still damp and unhardened introducing molten slag or matte within the converter or refining-furnace in sufficient quantities to completely dry and harden the lining material.

7. The within-described method of lining converters or refining-furnaces, consisting of first tamping the lining material around an inner core then removing the core and forming a slag or matte shell over the inner surface of the lining by the introduction of molten slag or matte.

8. The within-described method of lining converters or refining-furnaces, consisting of first, tamping the lining material around an inner core, then removing the core and partially drying the lining by forming a shell over

the inner surface of the lining by the introduction of molten material, then removing the molten material and completing the drying of the lining by the introduction of one or more additional ladles of molten material.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 6th day of November, 1905.

H. L. CHARLES.

Witnesses:
T. J. WALKER,
J. V. FLAHERTY.