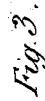


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Inventors:
George Robertson Bishop
by W Bailey
his attorney

UNITED STATES PATENT OFFICE.

GEORGE R. HISLOP, OF PAISLEY, COUNTY OF RENFREW, NORTH BRITAIN.

IMPROVEMENT IN REVIVIFYING SPENT LIME.

Specification forming part of Letters Patent No. **217,377**, dated July 8, 1879; application filed June 18, 1879.

To all whom it may concern:

Be it known that I, GEORGE ROBERTSON HISLOP, of Paisley, in the county of Renfrew, North Britain, have invented Improvements in Revivifying Spent Lime, of which the following is a specification.

My said invention consists of a process for revivifying or again rendering caustic lime which has been made foul in the process or operation of purifying coal or other illuminating gas, or in the manufacture of soap, soda-ash, caustic soda, or in other operations or processes; and my said invention consists, principally, in submitting the said lime to the direct action of the products of combustion from a furnace wherein carbonaceous matter, in the solid, liquid, or gaseous state, is burned.

In practicing my invention it is desirable to bring the products of combustion into as intimate contact as possible with the spent lime under treatment, and to present as great a surface of the lime as may be to the said products of combustion.

My invention may be carried into effect with several forms of apparatus consisting of chambers; but it is explained that my invention does not consist in the form or arrangement of the chambers, but in the process conducted in the said chamber or chambers. The spent lime is fed into an apparatus consisting of a chamber or chambers to contain the lime, the chamber or chambers being in communication at one end with a furnace in which carbonaceous matter is burned, and at the other end in communication with a chimney or other outlet, so that the products of combustion from the furnace pass over and in contact with the lime in the chamber or chambers on their way to the chimney or outlet. The chambers are preferably of but small diameter or depth, and in the case of a number of chambers they are so set or arranged that they communicate the one with the other at each end, so as to form a continuous passage for the products of combustion from one chamber to another, and so through all the chambers from the furnace to the chimney or outlet.

I here describe some arrangements of chambers by which the process constituting my invention may be successfully practiced.

Figure 1 of the accompanying drawings rep-

resents in longitudinal vertical section, and Fig. 2 partly in elevation and partly in transverse section, an arrangement of chamber suitable for carrying the process constituting my invention into effect.

The said chambers are shown in duplicate; but, as both sets are of the same construction, the description of one set will suffice.

The chambers A A¹ A² A³ are built one above the other, as shown. The chamber A, at the top, is a drying-chamber, and the others are calcining or revivifying chambers. A furnace, B, is in communication with the chambers by means of the flues *a a*, alternately, at either end of the chambers, so that the products of combustion from the said furnace pass through all the chambers in the presence of the lime, as indicated by the arrows. The chambers are each furnished with doors B', for the insertion of tools and the introduction, spreading, or withdrawal of the lime.

The bottoms of the chambers A A¹ A² have openings *a'* therein for the passage of the lime from chamber to chamber, the said openings being covered by tiles.

The spent lime to be treated is fed into the chamber A through the hopper C, and is there dried or partially treated; and from this chamber the lime is passed through the openings *a'* in the bottom thereof into the chamber A¹, and so on until all of the chambers have received such a charge as will allow free passage for the products of combustion above them. When the treatment of the lime in the three lower chambers, A¹ A² A³, is completed it is removed and the contents of the chamber A are discharged thereinto.

For the purpose of regulating the temperature of the different chambers or parts of the chambers air is admitted thereto by ventilating-boxes, marked C' in Fig. 2 of the drawings, by means of which boxes the air may be admitted to, controlled in, or cut off at any part of the apparatus.

Fig. 3 represents in longitudinal vertical section another arrangement of apparatus suited for the purposes of practicing the process constituting my invention.

B is the fire-place, from which the products of combustion pass through the series of chambers D E F G, the part D being the finishing-

sole; E, the lower retort; F, the upper retort, and G the hopper, the said products passing by the flues H down the sides of the retort to the flue H¹ beneath, then up to the flue H², and thence to the chimney. The spent lime is fed into the retort at I, and the finished lime is drawn out at K.

The retort contains five charges at one time, viz: one on the sole D, one in the lower, and one in the upper retort, E F, and two in the hopper G. By means of rakes passed through the door J these charges are successively drawn and pushed forward one remove, and as each remove is made a fresh charge is inserted into the hopper G, so that all the charges pass successively from the hopper G to the retort F, thence to the retort E, thence to the sole-plate D, and are finally withdrawn from the chamber.

Two or any number of these chambers may be combined in one setting.

In order to present a larger surface of lime to the action of the products of combustion the chambers in which the revivifying process is carried on may be made to rotate, if desired, being then preferably made circular, and it may be in the form of one long tube, and the lime may be caused to pass slowly and continuously down through the chamber or chambers by setting them at an inclination, the lower end being that at which the furnace is situated, so that the lime and the products of combustion pass in reverse directions.

Instead of giving motion of rotation to the cylinders or chambers they may receive an oscillatory motion, when a suitable shape in cross-section will be that of an ellipse.

A jet of saturated or superheated steam may be used to assist the products of combustion in their revivifying action, the said steam being preferably injected at the lower end of the cylinders or chambers or into the furnace.

In the process of revivifying lime, as hereinbefore described, the lime, when at the part of the chamber or chambers farthest from the furnace—that is, at the first part of its treatment—is desulphurized by the carbonic acid discharged from the lime at the part of the chamber or chambers near to the furnace by the intense heat at that part.

When oxide of iron is employed the foul lime, being in a state of carbonate, can be revived at once, and may be used and revived a great number of times; but where no oxide

of iron is used the foul lime is largely charged with sulphur, as well as with carbonic acid and other impurities, and cannot be reused and revived nearly so frequently as can the lime where oxide of iron is used or otherwise produced in the form of carbonate. In order to render this lime more durable, the waste gases from the retort-furnaces, steam-boiler furnaces, or the calcining-chambers themselves, consisting chiefly of carbonic-acid gas, are drawn by a pump or other suitable means, and forced up through the spent lime in the purifier after it has been shut off from the gas as fouled.*

The passages or pipes are provided with the necessary back-draft valves.

The carbonic-acid gas from the furnaces, before they enter the purifier, are cooled to 150° Fahrenheit, or to a lower temperature, by passing them through a cold-water or other condenser on their way to the purifier.

A small jet of steam may be injected along with the furnace-gases into the purifier.

By this process the carbonic-acid gas from the sources referred to on being passed through the sulphureted lime in the purifier displaces the sulphur, chiefly in the form of sulphureted hydrogen, and combines with the lime, forming lime carbonate, and the discharged gases from the fouled purifier may be passed through oxide of iron, in order that it may absorb the sulphur. The lime thus carbonated is treated in calcining-chambers, as hereinbefore described, and revived.

I claim—

1. The process of revivifying spent lime by submitting it to the direct action of the products of combustion from a furnace wherein carbonaceous matter is burned, also assisting the action of the said products by a jet or jets of saturated or superheated steam.

2. The hereinbefore-described treatment of spent lime to prepare it for recalcination—namely, desulphurizing it by passing furnace-gases through it while in the purifiers.

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

GEORGE ROBERTSON HISLOP. [L. S.]

Witnesses:

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