No. 677,457. Patented July 2, 1901.

B. B. LATHBURY & H. S. SPACKMAN.

APPARATUS FOR CALCINING CEMENT.

(Application filed Sept. 26, 1900.)

(No Model.) 2 Sheets—Sheet 1.

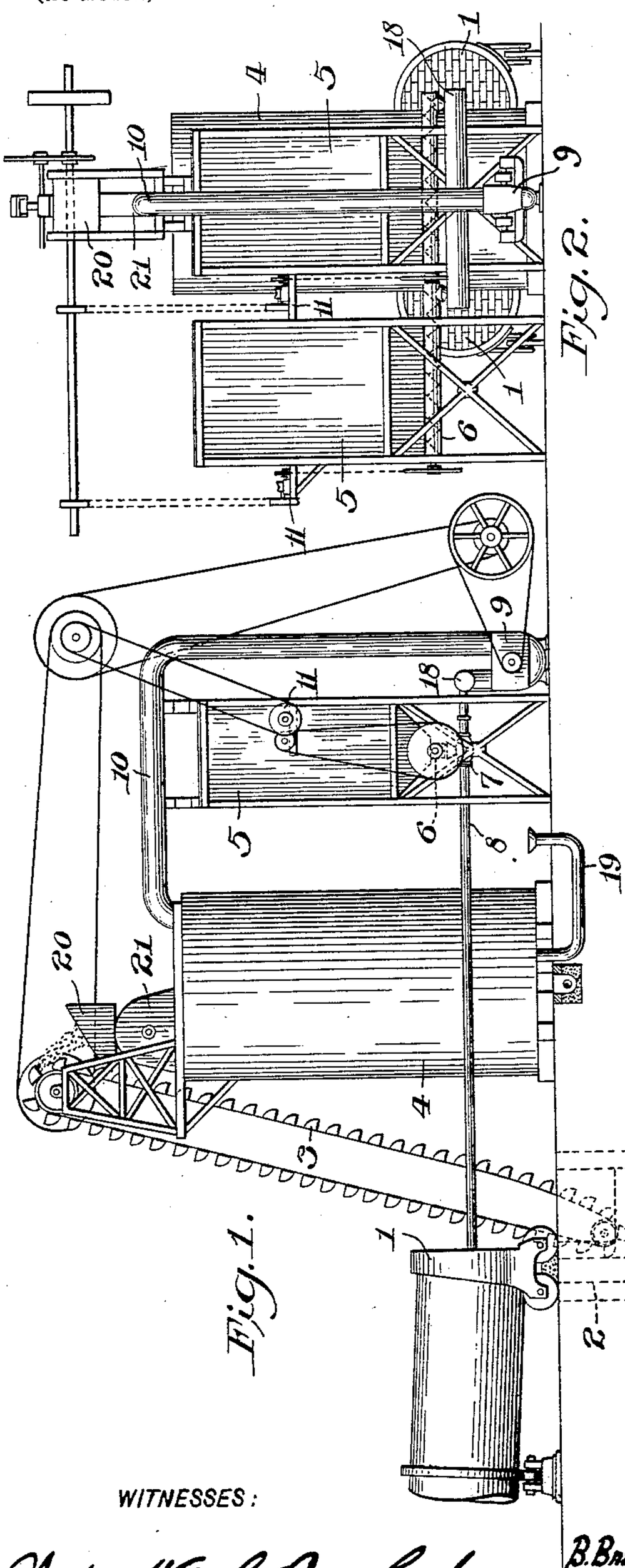

Fig. 1.

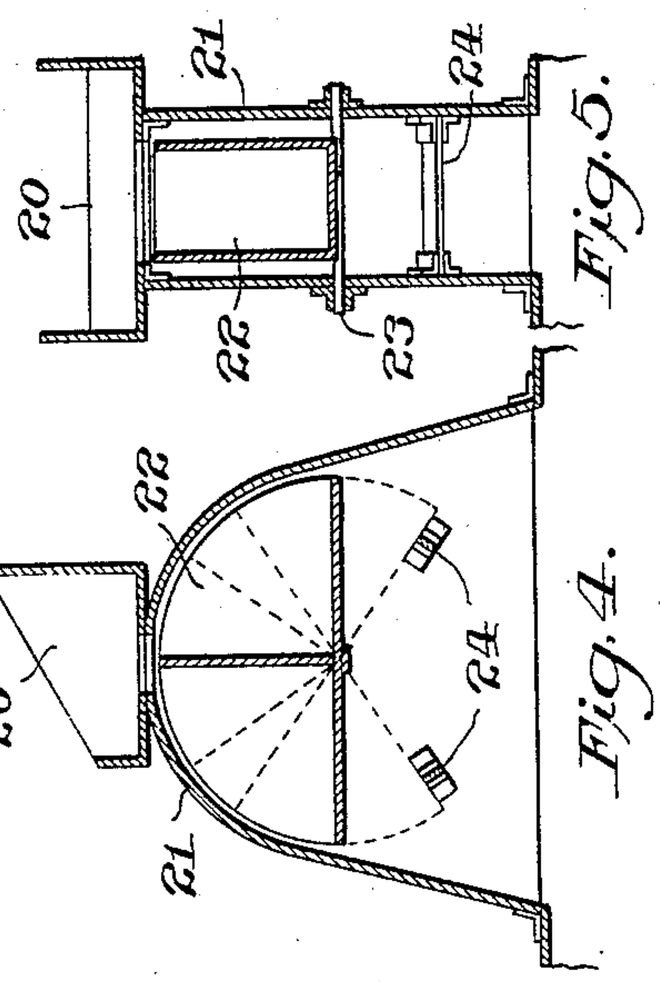

Fig. 5.

Fig. 4.

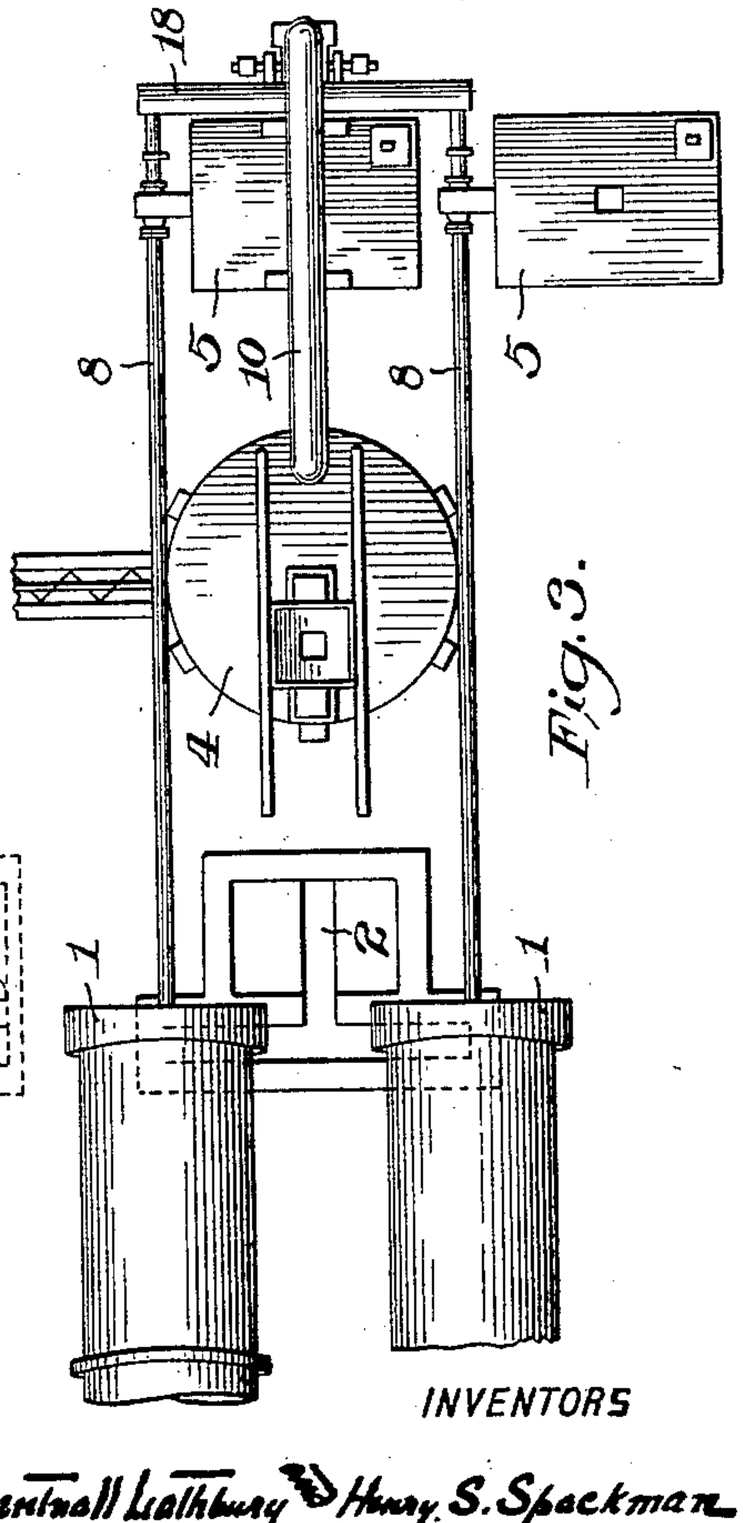

Fig. 3.

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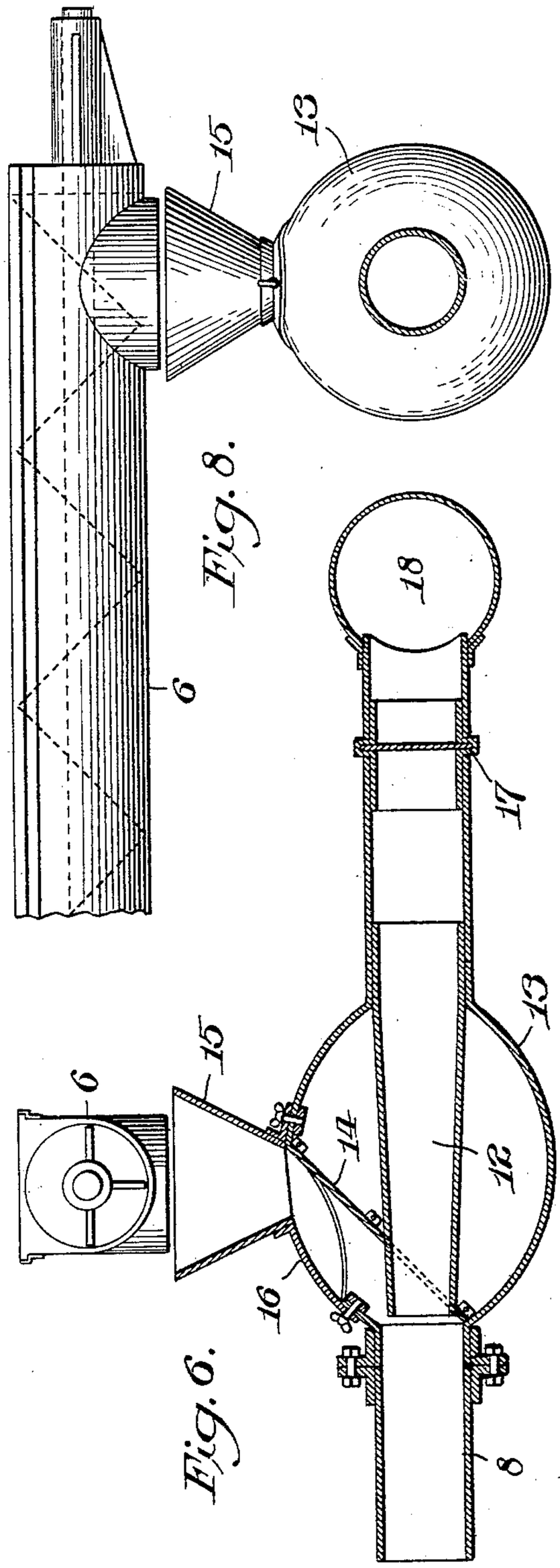

Fig. 8.

Fig. 6.

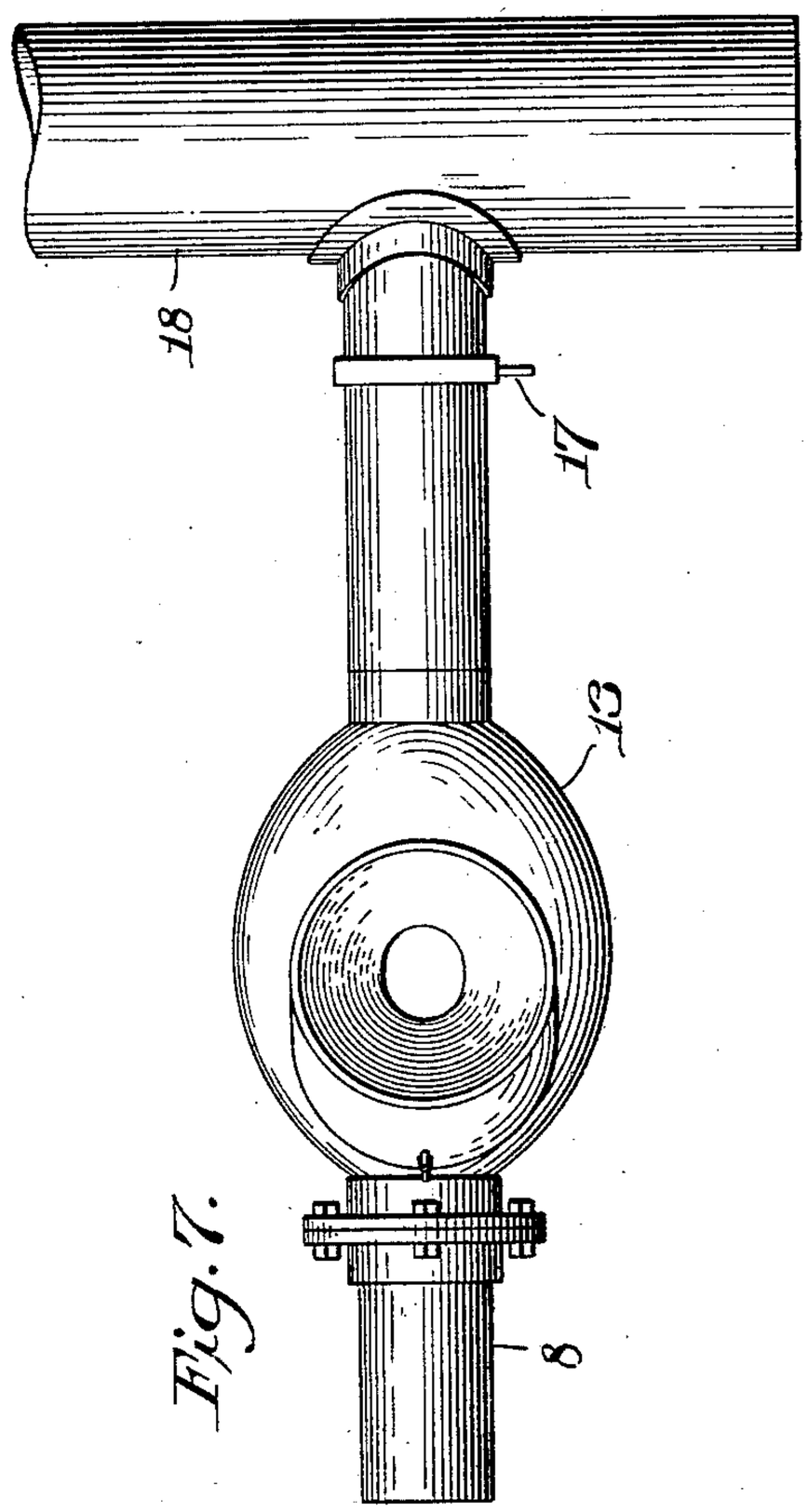

Fig. 7.

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UNITED STATES PATENT OFFICE.

BENJAMIN BRENTNALL LATHBURY, OF PHILADELPHIA, AND HENRY S. SPACKMAN, OF ARDMORE, PENNSYLVANIA.

APPARATUS FOR CALCINING CEMENT.

SPECIFICATION forming part of Letters Patent No. 677,457, dated July 2, 1901.

Application filed September 26, 1900. Serial No. 31,152. (No model.)

To all whom it may concern:

Be it known that we, BENJAMIN BRENTNALL LATHBURY, residing at No. 250 South Forty-fifth street, in the city and county of Philadelphia, and HENRY S. SPACKMAN, residing at Ardmore avenue, Ardmore, in the county of Montgomery, State of Pennsylvania, citizens of the United States, have invented new and useful Improvements in Apparatus for Calcining Cement, of which the following is a specification.

Our invention relates to that class of apparatus wherein powdered fuel is employed in the calcination of cement; and one object is to provide a means whereby the waste hot air arising from the calcination of the cement, or, more specifically, from the cooling of the cement-clinker, may be utilized in blowing such fuel into the kiln or furnace.

A further object of our invention is to provide as an element in apparatus of the foregoing class a simple and efficient means for bringing the powdered fuel into contact with the air-blast in such manner as that the former may be effectively mixed with and acted upon by the latter.

We attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a general view, in side elevation, of the entire apparatus. Fig. 2 is an end view of the entire apparatus. Fig. 3 is a view in plan of the entire apparatus as shown in Fig. 1, exclusive of the elevator. Fig. 4 is a side sectional view of the device whereby the material is received from the elevator and fed into the cooler. Fig. 5 is an end sectional view of said device. Fig. 6 is vertical section, on a larger scale, of the device whereby the powdered fuel is brought into contact with the air-blast. Fig. 7 is a general view of the same from above. Fig. 8 is a view of the receiver and hopper, showing the communication of the screw conveyer therewith.

Under existing methods for the manufacture of cement the raw material, consisting generally of limestone and clay, is finely ground and fed either dry or mixed with a certain amount of water into a rotary kiln or furnace and there burned to the point of vitrification, the necessary heat being supplied by the combustion of powdered coal or oil blown into the kiln or furnace under suitable air-pressure. The vitrified material issues from the kiln in the form of clinker at or near white heat, when it is cooled by air-currents or by the application of water, or both in conjunction, until in condition to be ground into finished cement.

In order to burn one pound of coal, one hundred and fifty cubic feet of air, approximately, is required, and the injection of this air into the furnace at the atmospheric temperature, as is done under existing methods, involves a waste of fuel in heating this air up to a temperature of about 2,500° Fahrenheit.

In our improved apparatus we employ the air heated in the cooler by contact with the white-hot clinker as a blast to carry the powdered fuel into the kiln, thereby securing a saving in fuel, as above described.

In Fig. 1, 1 is the discharge end of a cement kiln or furnace from which the clinker as it forms is discharged into the pit 2. Thence the clinker is carried by the elevator or conveyer 3, of any suitable description, to the hopper 20, whence it is fed, by means of the distributer 21, into the cooler 4. This cooler may be any suitable variety of the well-known class wherein the clinker is cooled by contact with ascending air-currents drawn in at the bottom of the cooler through the inlet 19 and circulating upward through the material to be cooled.

Pulverized fuel stored in the bins 5, Fig. 2, is fed, by means of the screw conveyer 6, into the receivers 7, which latter are mounted in the fuel-discharge pipes 8. An air-blast is created in said fuel-discharge pipes by the blower 9, of any suitable description, the air-supply for said blower being drawn from the cooler 4 by the hot-air conduit 10. The rotation of the screw conveyer 6 is regulated by a speed-regulating device, (indicated at 11,) which may be of any suitable description.

In Fig. 1 a single kiln, fuel-bin, and discharge-pipe are shown. In Figs. 2 and 3 these elements are duplicated. In the practical operation of our invention either form may be employed.

In Figs. 4 and 5, 22 is a double bucket, each

compartment of which has the form of a quarter-circle, as shown in Fig. 4. This double bucket is adapted to rotate about the axis 23, its rotation in either direction being limited by the bars or rods 24. Material carried up by the elevator 3 is dumped into the hopper 20, whence it passes into the compartments of the bucket 22, which rotates in either direction under the weight of said material until stopped by the bars 24, when the material is discharged into the cooler. The position of the bucket 22 when discharging on either side is shown by the dotted lines in Fig. 4. It is important that the hot air generated in the cooler should not escape through the opening in the latter through which the clinker is introduced from the kiln. It will be observed that the employment of the above-described means for feeding the clinker into the cooler fulfils this requisite, since at no position of the double bucket 22 is there a direct egress for the hot air, the bucket-casing 21 fitting so closely to the walls of the bucket-compartments as to afford slight opportunity for the escape of air by that means.

One of the receivers 7 is shown in detail in Figs. 6, 7, and 8. Our object herein is to provide a device which shall embody an effective means for mixing powdered fuel with an air-blast and which shall be readily attachable to the feed or discharge pipes of powdered, fuel-burning apparatus. In Fig. 6, 8 is the fuel-discharge pipe, in which the receiver is mounted. The receiver is composed of the nozzle 12, surrounded, save at the orifice of said nozzle, by the shell 13. The diaphragm 14 extends entirely across the interior of said shell and is attached to the inner walls thereof. The hopper 15 communicates with the interior of said shell through an opening in the top thereof. The relative positions of the hopper 15 and diaphragm 14 are such that powdered fuel introduced into said hopper is deposited by the slant of said diaphragm directly in front of the orifice of the nozzle 12, which pierces said diaphragm, as shown in Fig. 6. The shell 13 has attached thereto the cap or cover 16, which fits over the opening in said shell, being removably attached thereto, as shown in Fig. 6, in order to readily remedy any clogging of the shell 13 or nozzle 12 that may occur through the introduction of any large pieces of fuel or by foreign substances. The wind-gate 17, Figs. 6 and 7, controls the admission of air from the drum 18 to the receivers 7 and fuel-discharge pipe 8. In Fig. 8 is shown the communication of the screw conveyer 6 with the hopper of the receiver.

The blower 9, Fig. 1, when in operation causes air at atmospheric temperature to be drawn in at the bottom of the cooler 4 by means of the inlet 19, said air in its passage upward through the cooler being heated by contact with the clinker in the process of cooling the latter. This hot air is then drawn from the top of the cooler by the hot-air conduit 10 and passing through the blower is discharged into the drum 18, Figs. 1 and 2, whence it passes to the fuel-discharge pipe 8, Fig. 3.

It will be observed that by our combination and arrangement of parts we are enabled to draw cold or cool air in at the bottom of the cooler, where in its upward passage through the cooler it cools the clinker therein, becoming itself highly heated in the process, and that by means of our hot-air conduit we are enabled to employ this heated air as a blast for the introduction of fuel into the kiln, the air current or blast through the cooler, hot-air conduit, and fuel-discharge pipe being continuous.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In combination in an apparatus for the utilization of powdered fuel in the calcination of cement, a fuel-discharge pipe, a receiver mounted therein and adapted to feed said fuel to the air-blast, a powdered-fuel receptacle, means such as the screw conveyer 6 for conveying fuel from said receptacle to said receiver, a cooler, a hot-air conduit connecting said cooler and said fuel-discharge pipe, and a blower communicating with said hot-air conduit intermediate between said cooler and said fuel-discharge pipe, whereby a continuous air-current is created through said cooler and fuel-discharge pipe, substantially as described.

2. In an apparatus for the calcination of cement, a calcining-furnace, a cooler wherein the temperature of the clinker is lowered by subjection to air-currents, means for transferring said clinker from said furnace to said cooler, a fuel-discharge pipe, a hot-air conduit connecting said cooler and said fuel-discharge pipe, a blower adapted to create a continuous air-current through said cooler, hot-air conduit and fuel-discharge pipe, a receiver mounted in said fuel-discharge pipe and adapted to mix said fuel with said air-currents and a powdered-fuel bin communicating with said receiver by means of a screw conveyer, substantially as described.

3. In an apparatus for the calcination of cement, a calcining-furnace, a cooler wherein the temperature of the clinker is lowered by subjection to air-currents, means such as the conveyer 3 for transferring said clinker from said furnace to said cooler, the double bucket 22 adapted to receive said clinker from the conveyer, a fuel-discharge pipe, a hot-air conduit connecting said cooler and said fuel-discharge pipe, a blower communicating with said hot-air conduit and adapted to create a continuous air-current through said cooler, hot-air conduit and fuel-discharge pipe, a receiver mounted in said fuel-discharge pipe and adapted to mix said fuel and said air-current, and a powdered-fuel bin communicating with said receiver by means of a screw conveyer, substantially as described.

4. In combination, the cooler 4, the double bucket 22 communicating therewith, the cement-kiln 1, means such as the conveyer 3 for conveying the product of said kiln to said double bucket, the discharge-pipe 8 having mounted therein the receiver 7, the powdered-fuel receptacle 5 communicating with said receiver by means of the worm 6, and means such as the hot-air conduit 10 and fan 9 whereby a continuous updraft of cold air is created through said cooler and a discharge of hot air is created through said discharge-pipe, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

B. BRENTNALL LATHBURY.
HENRY S. SPACKMAN.

Witnesses:
OMAR J. KINSLEY,
JAMES N. KENNEDY.