

No. 751,134.

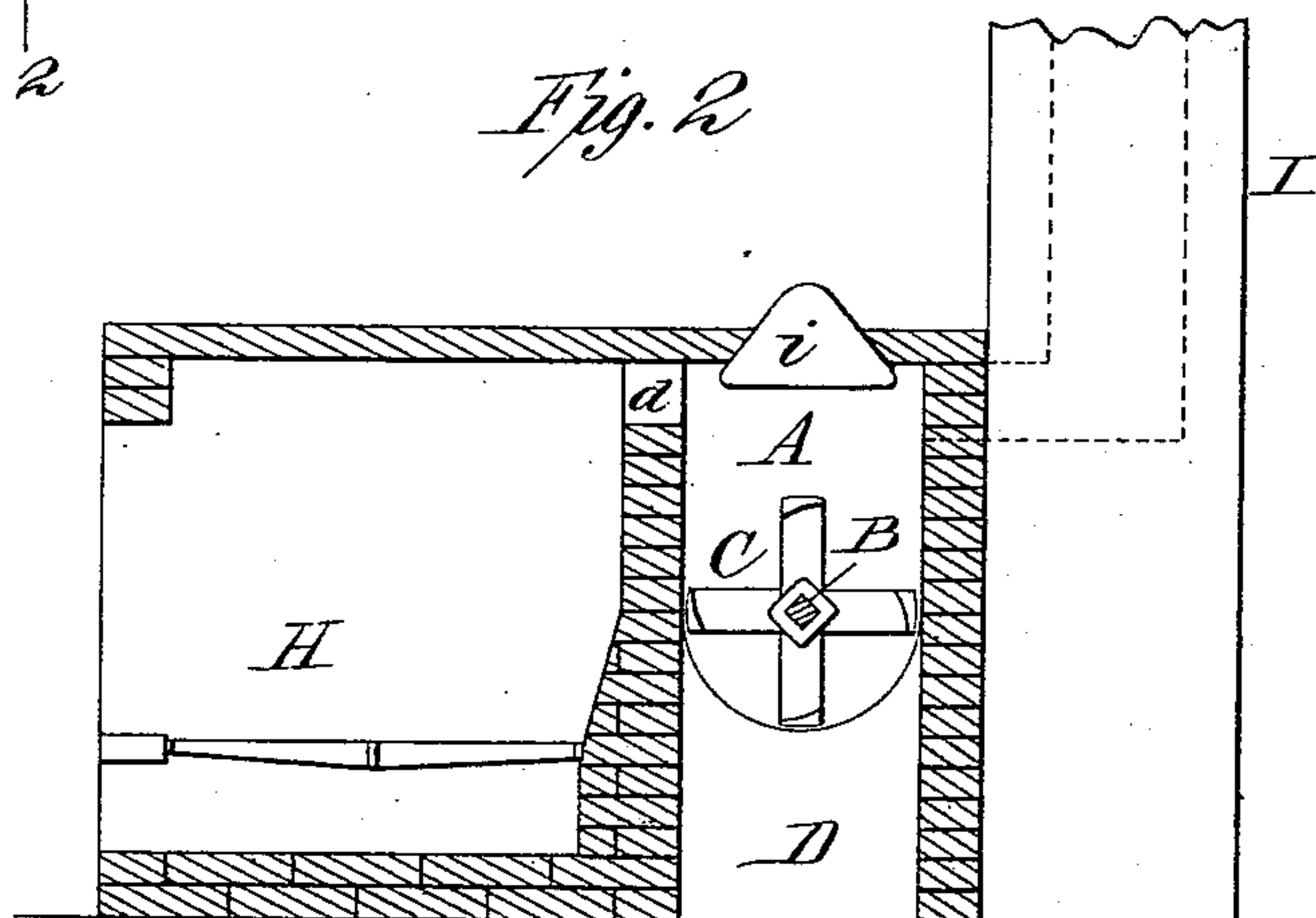
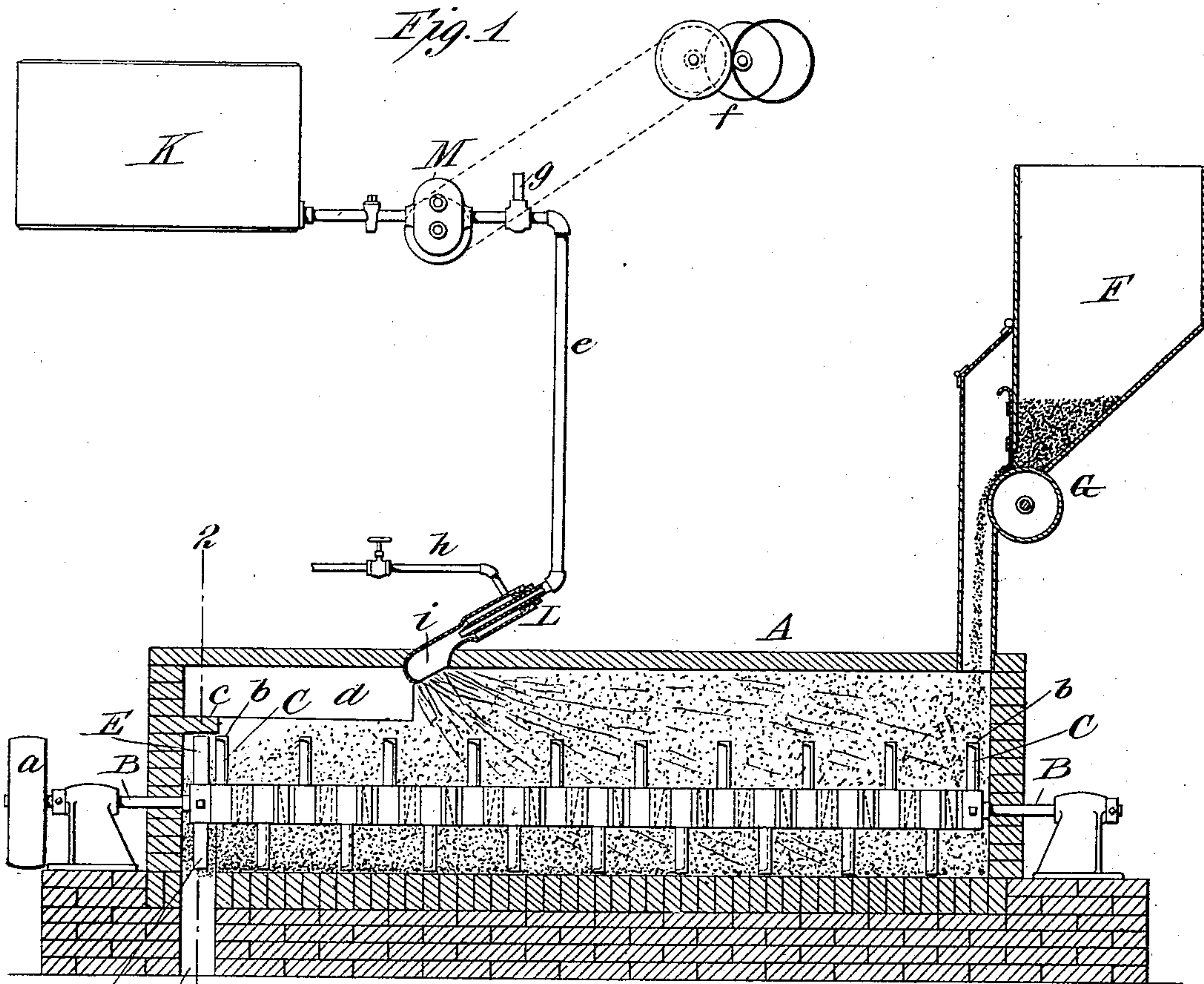
PATENTED FEB. 2, 1904.

E. B. A. & R. A. ZWOYER.
PROCESS OF PREPARING PULVERULENT MATERIALS FOR
MOLDING OR BRIQUETING.

NO MODEL.

APPLICATION FILED MAY 12, 1903.

2 SHEETS—SHEET 1.



Witnesses:

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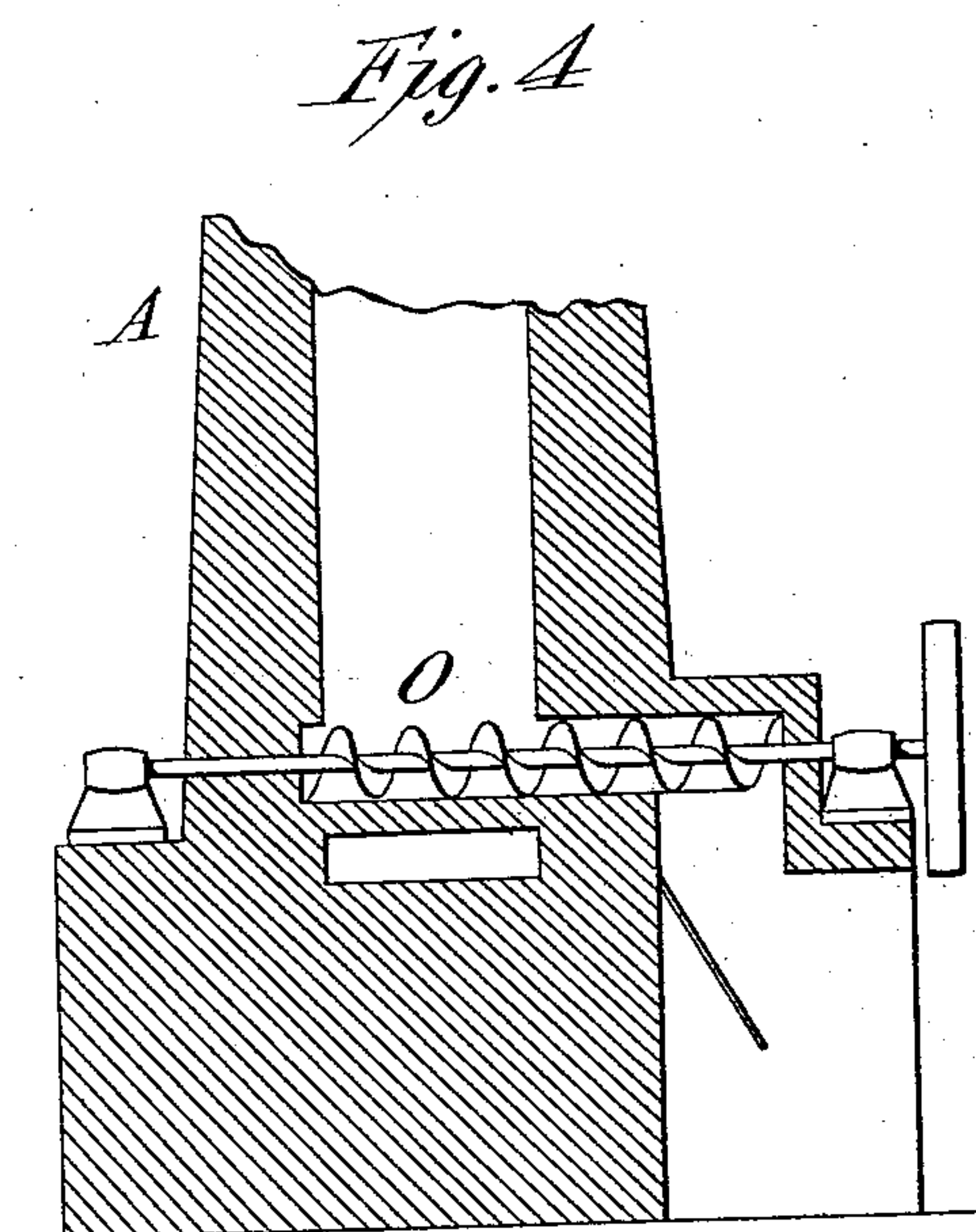
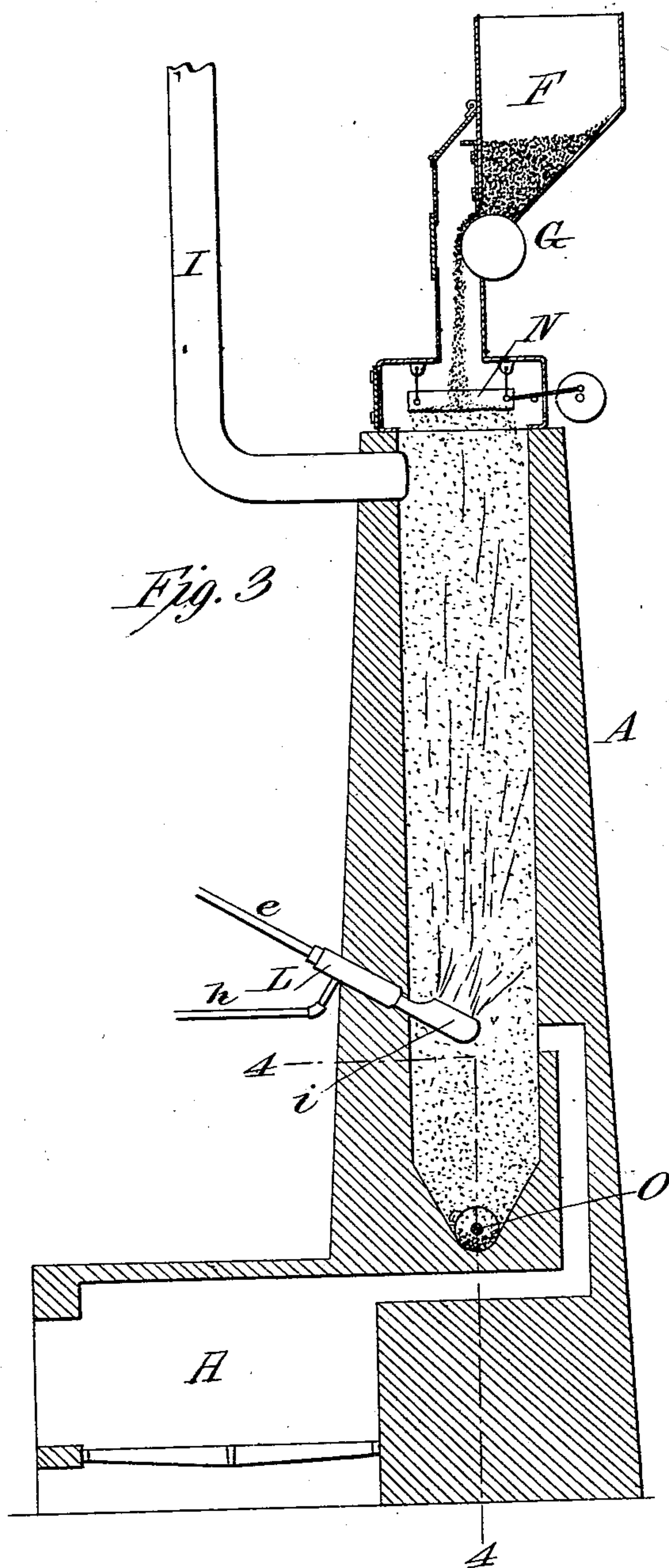
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UNITED STATES PATENT OFFICE.

ELLSWORTH B. A. ZWOYER AND ROLLAND A. ZWOYER, OF HOBOKEN, NEW JERSEY, ASSIGNORS TO THE ZWOYER FUEL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

PROCESS OF PREPARING PULVERULENT MATERIALS FOR MOLDING OR BRIQUETING.

SPECIFICATION forming part of Letters Patent No. 751,134, dated February 2, 1904.

Application filed May 12, 1903. Serial No. 156,749. (No specimens.)

To all whom it may concern:

Be it known that we, ELLSWORTH B. A. ZWOYER and ROLLAND A. ZWOYER, citizens of the United States, residing at Hoboken, in the county of Hudson and State of New Jersey, have invented a certain new and useful Improvement in Processes of Preparing Pulverulent Materials for Molding or Briqueting, of which the following is a description.

The object we have in view is to produce a simple and effective process for preparing pulverulent materials for molding or briqueting, and particularly for mixing a binder therewith, and for suitably heating or roasting the material.

Our process is applicable to any pulverulent material which it is desired to briquet or mold in any desired shape—such as coal-dust, culm, minerals of all kinds, rare earths, &c.

In carrying out our method we pass the pulverulent material through a mixing-chamber in a suspended condition, in which the particles are separated from each other. While in this condition we pass the binder through the material in a finely-divided condition by atomizing the binder if a liquid or blowing it if in a powdered form, so as to produce a cloud of the binder, which passes through the separated or suspended particles of the pulverulent material, coating the same thoroughly and uniformly. We also, preferably at the same time, heat or roast the pulverulent material by passing through the same while the particles are in the free and suspended condition hot gases, such as will be produced from the combustion of fuel in a suitable furnace. The quantity of the pulverulent material and of the binder and the temperature and flow of the gases will be regulated and coördinated so as to produce the required heating or roasting and the required conditions of mixture with the minimum quantity of the binder. The mixture with its particles heated and coated with the binder is then delivered to suitable machines for molding or briqueting the same.

Apparatus which may be used in the carrying out of the process is illustrated in the ac-

companying drawings, in connection with the description of which the details of the process will be more completely disclosed.

Figure 1 is a vertical longitudinal section of a horizontal mixer with associated parts adapted to carry out the process. Fig. 2 is a vertical cross-section on the line 2 2 in Fig. 1. Fig. 3 is a vertical section of a vertical mixer adapted to carry out the process, and Fig. 4 is a vertical section of the lower end of the mixer of Fig. 3 on line 4 4 in Fig. 3.

Referring particularly to Figs. 1 and 2, A is a horizontal chamber lined with fire-brick, having a rounded or trough-shaped bottom. Lengthwise through this chamber near its bottom passes a shaft B, mounted in journals outside of the chamber and driven in any suitable way, as by a belt running over the pulley *a*. Upon the shaft B are secured a number of radial blades or paddles C, whose broad faces are transverse to the shaft, the front faces of the blades being beveled at a small angle, so as to feed the pulverulent material lengthwise through the chamber. The ends of the blades are provided with laterally-extending lips *b*, which lift the pulverulent material from the trough-like bottom of the chamber and throw it upwardly against the top of the chamber, from whence it again falls to the bottom. At the discharge end of the chamber is a discharge-opening D in the bottom thereof, and above this discharge-opening the end wall of the chamber is extended to form a shelf *c*. At this end of the shaft B are provided two radial paddles E, whose blades are in the same plane as the shaft, the paddles E revolving under the shelf *c* and above the discharge-opening D, so as to discharge the material through said opening. At the other end of the chamber A the pulverulent material is fed from a suitable hopper or receptacle F by means of a roller or other suitable feed G through the top or cover of the chamber. The feed G is adapted to be adjusted so as to deliver a regulated quantity of pulverulent material. At the other end of the chamber A is located a furnace H, the outlet from the combustion-chamber of which is through a flue *d*, leading into the chamber A.

near its top at its discharge end. At the feed end of the chamber and connected with the top thereof is an uptake I, leading to a suitable stack or chimney.

5 K is a tank or receptacle containing the binder, preferably in a liquid form. A pipe *e* leads from this tank to the atomizer L. In the line of the pipe *e* is a rotary feed-pump M, which is driven from a variable-speed
10 counter-shaft *f*. A spring or weight-loaded valve *g* between the pump M and the atomizer L prevents the binder from flowing through the pipe *e* when the pump M is not in operation. A pipe *h* delivers compressed air or steam to
15 the atomizer L. The atomizer delivers the atomized binder to a spoon or hood *i*, which projects through the top wall or cover of the chamber A, preferably near the discharge end of the chamber, and delivering the atomized
20 binder toward the receiving end of the chamber. This spoon scatters or distributes the atomized binder over a large area, so as to spread it uniformly through the suspended material above the shaft B in the form of vapor
25 or fog and also lessen the force of the atomized stream. The current of hot gases carries the cloud of finely-divided binder through the suspended pulverulent material to the uptake I; but the force of this current is so regulated
30 that it will not be sufficient to carry any substantial portion of the pulverulent material into the uptake. The quantity of binder delivered is determined by the speed of the pump M, which is variable to regulate the
35 quantity, and the pressure of the steam or air in the pipe *h* can be also regulated by means of a valve in that pipe. An excess of binder will be shown by the presence of binder in the
40 gases delivered to the uptake I or the condition of the material discharged through the opening D. The flow of the hot products of combustion from the furnace H can be controlled and regulated by any well-known means.

45 The pulverulent material is fed in a regulated quantity to the receiving end of the chamber A and falls to the trough-like bottom of that chamber, where it is caught by the blades C and thrown upwardly to the top of the chamber,
50 from which it falls back upon the blades. Such blades may at the same time give the material a forward feed or progression through the chamber. The shaft B is driven at a relatively high speed—say from two hundred to
55 three hundred revolutions per minute for blades having a radius of from eight to nine inches, so that the blades will throw the pulverulent material into the top of the chamber, in which it will rise and fall with the particles
60 in a separated or suspended condition. The pulverulent material is therefore fed through the chamber progressively and in a suspended condition in one direction, while the hot gases and the finely-divided binder pass through the
65 chamber in the opposite direction, coming

into contact with the individual particles of the pulverulent material. The hot gases thoroughly and evenly heat or roast the material in a progressive manner, a condition which is desirable in most cases to produce either a
70 chemical change or to get rid of moisture or to heat the material so as to facilitate hardening after the material is molded, or to heat the material so as to keep the binder in a liquid or plastic state, or to do all these things
75 at the same time. The binder is brought progressively into contact with fresh or uncoated particles of the pulverulent material as it passes through the material toward the uptake I, so that it is wholly utilized before it reaches
80 the uptake in producing a uniform and even coating upon the individual particles. If the binder is in the form of a powder, as it may be, a suitable modification of the binder-feeding devices will enable the binder to be blown
85 into the mixer and to be carried forward by the hot gases toward the uptake, coating the particles of the pulverulent material as it passes through them. When the material reaches the discharge-opening D, it is dis-
90 charged therethrough by the blades E and is delivered to the briqueting or molding machines. This method of mixing the binder with the pulverulent material and of producing the necessary heating or roasting of the
95 same is one which can be carried on rapidly and at the same time will produce a complete and uniform coating of the particles by the binder, thus requiring only the minimum amount of binder to produce a satisfactory re-
100 sult. The operation also is one which can be carried on with a small expenditure of power and with a minimum wear in the apparatus. It is evident that two or more of these mixers may be connected end to end, the pulverulent
105 material being supplied to the receiving end of one mixer and being discharged into the next mixer, while the binder and the heating-gases can be supplied to one mixer or separately to each or to any number of the mixers. 110

The process is likewise capable of being carried on in one or in a connected series of vertical mixers in which the pulverulent material falls through the vertical chamber by gravity instead of being fed through by blades or pad-
115 dles. Such a vertical mixer is illustrated in Figs. 3 and 4. The hopper F is located at the top of the vertical chamber A and delivers the pulverulent material by the feed G to a shaking-screen N or other device for spread-
120 ing out the stream of pulverulent material. The stream of pulverulent material, with its particles in a separated or suspended condition, passes through the chamber A to the bottom of the chamber, where a feed-screw O,
125 which is normally covered with the material, so as to prevent the entrance of air at the bottom of the chamber, discharges the material to one side to be delivered to a briqueting or molding machine or to another mixer. The 130

hood or spoon \dot{z} of the atomizer L projects through the side wall of the mixer near the lower end of the chamber A. The furnace H delivers the hot gases to the chamber A above its lower end, while the uptake I is connected with the chamber A at its upper end.

It is evident that our process can be carried out with various forms of apparatus, those shown and described being simply illustrative of suitable apparatus for the purpose. Such apparatus is not claimed herein, but will be made the subject of other applications for patents. One such application is filed simultaneously herewith, Serial No. 156,748.

What we claim is—

1. The process of mixing a binder with pulverulent material, consisting in adding the binder in a finely-divided form to such material when the particles of the material are maintained in a suspended or separated condition, substantially as set forth.

2. The process of mixing a binder with pulverulent material, consisting in passing the pulverulent material through a chamber with its particles in a suspended or separated condition, and passing the binder in a finely-divided form through said chamber, substantially as set forth.

3. The process of preparing pulverulent materials for molding or briqueting, consisting in maintaining the pulverulent material with its particles in a suspended or separated condition, heating such material while so suspend-

ed, and simultaneously adding a binder in a finely-divided form thereto, substantially as set forth.

4. The process of preparing pulverulent materials for molding or briqueting, consisting in maintaining the pulverulent material with its particles in a suspended or separated condition, heating such material while so suspended, and simultaneously passing through such suspended material a stream of the binder in a finely-divided form, substantially as set forth.

5. The process of preparing pulverulent materials for molding or briqueting, consisting in maintaining the pulverulent material with its particles in a suspended or separated condition and passing therethrough hot gases and a binder in finely-divided form, substantially as set forth.

6. The method of preparing pulverulent materials for molding or briqueting, consisting in passing the pulverulent material in one direction through a chamber with its particles in a suspended or separated condition, and passing in the other direction through said chamber hot gases and a binder in finely-divided form, substantially as set forth.

This specification signed and witnessed this 9th day of May, 1903.

ELLSWORTH B. A. ZWOYER.

ROLLAND A. ZWOYER.

Witnesses:

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