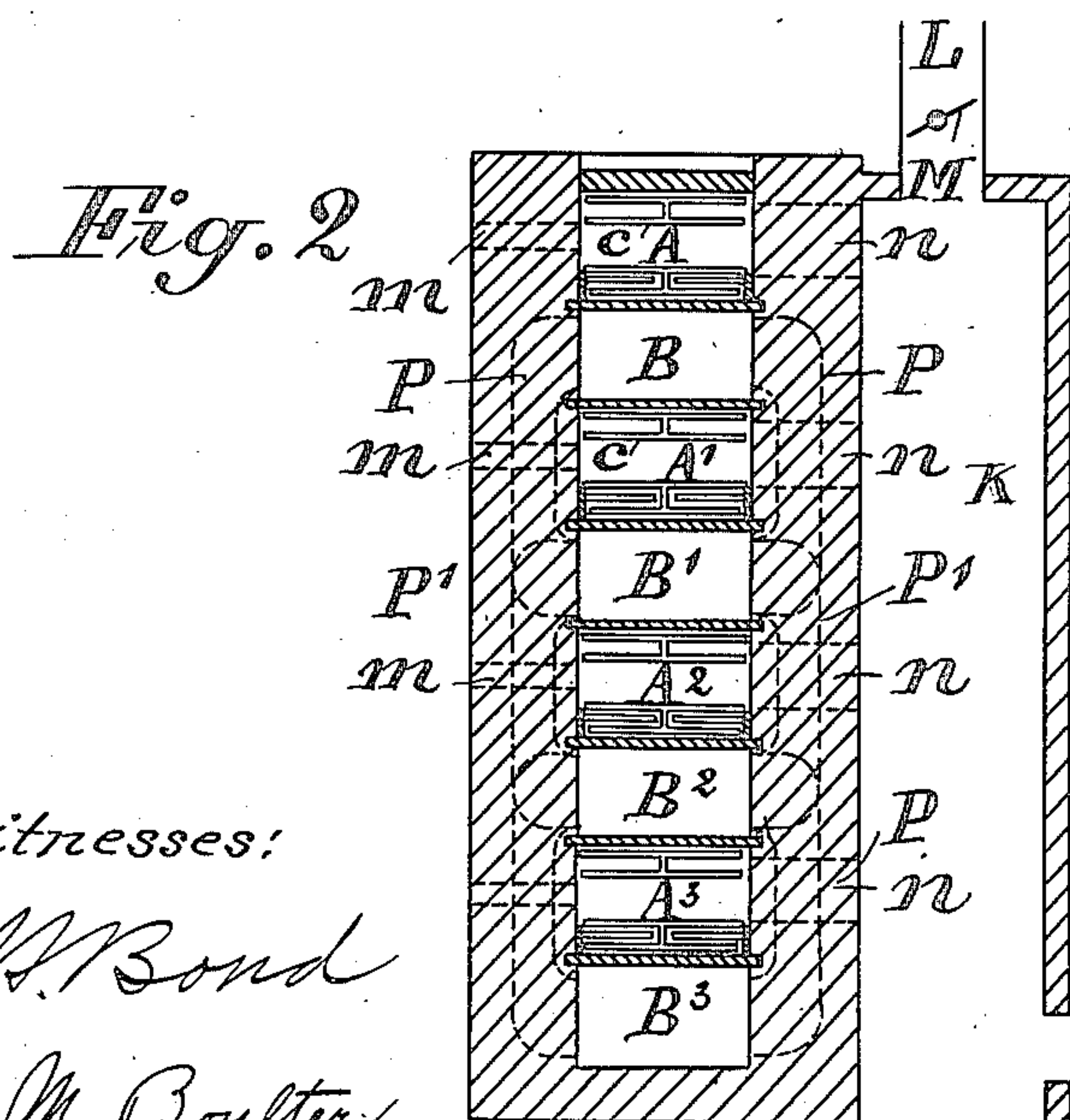
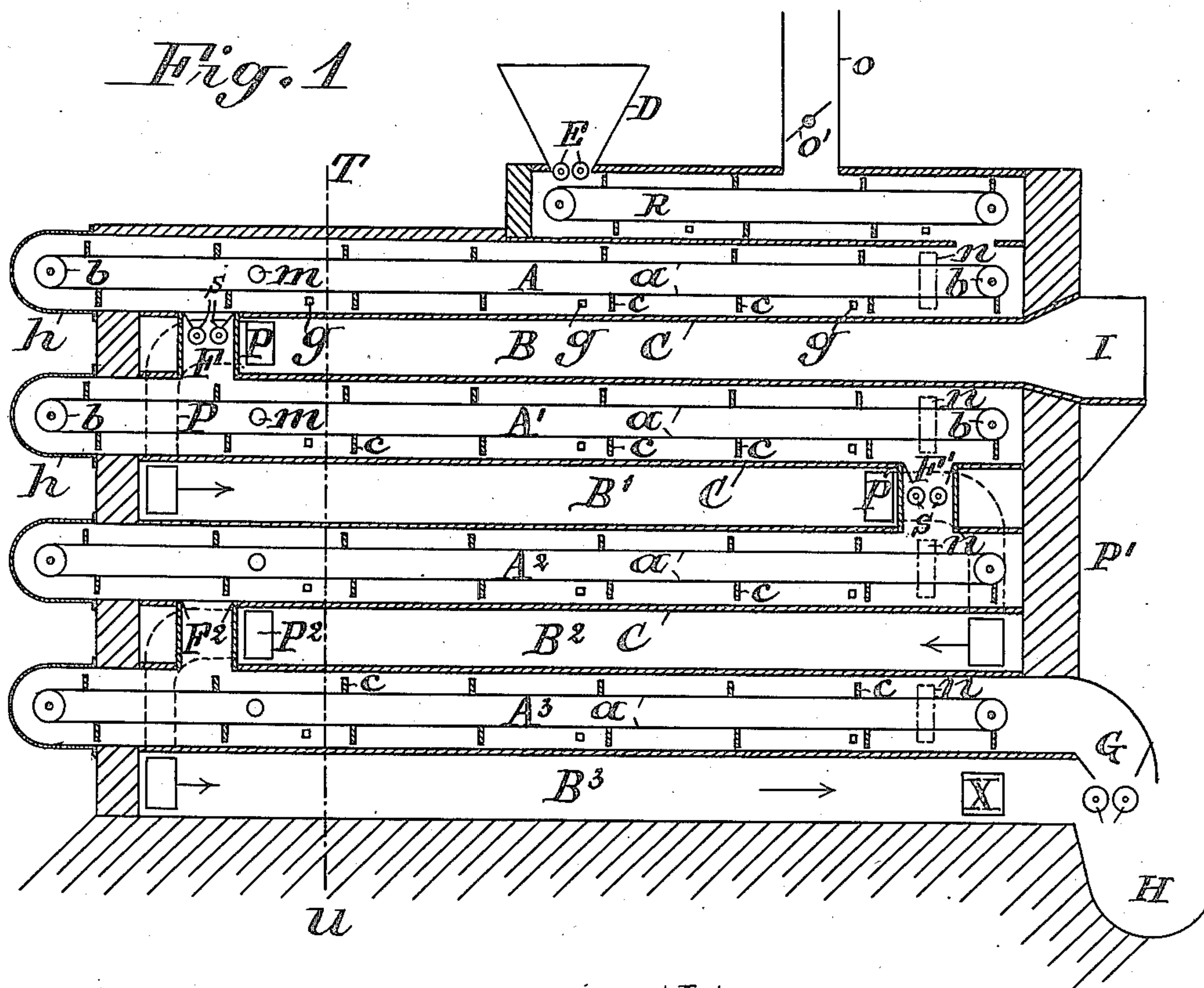


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 APPARATUS FOR DRYING AND CHARRING MATERIALS.  
 APPLICATION FILED SEPT. 13, 1907.

951,804.

Patented Mar. 15, 1910

2 SHEETS—SHEET 1.



witnesses:

E. H. Bond

C. M. Boulter

Inventor:

N. K. H. Ekelund

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 Attorney

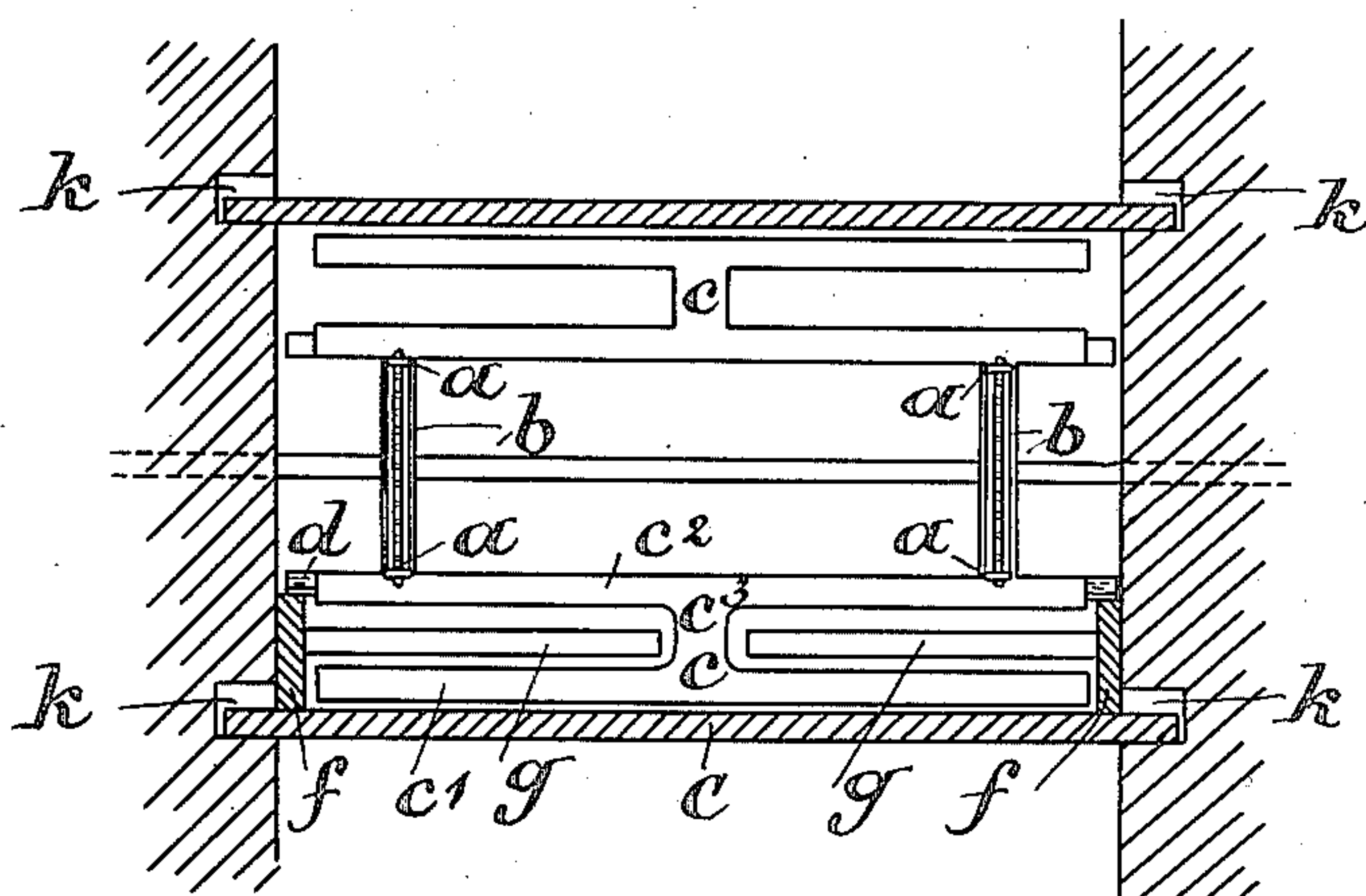
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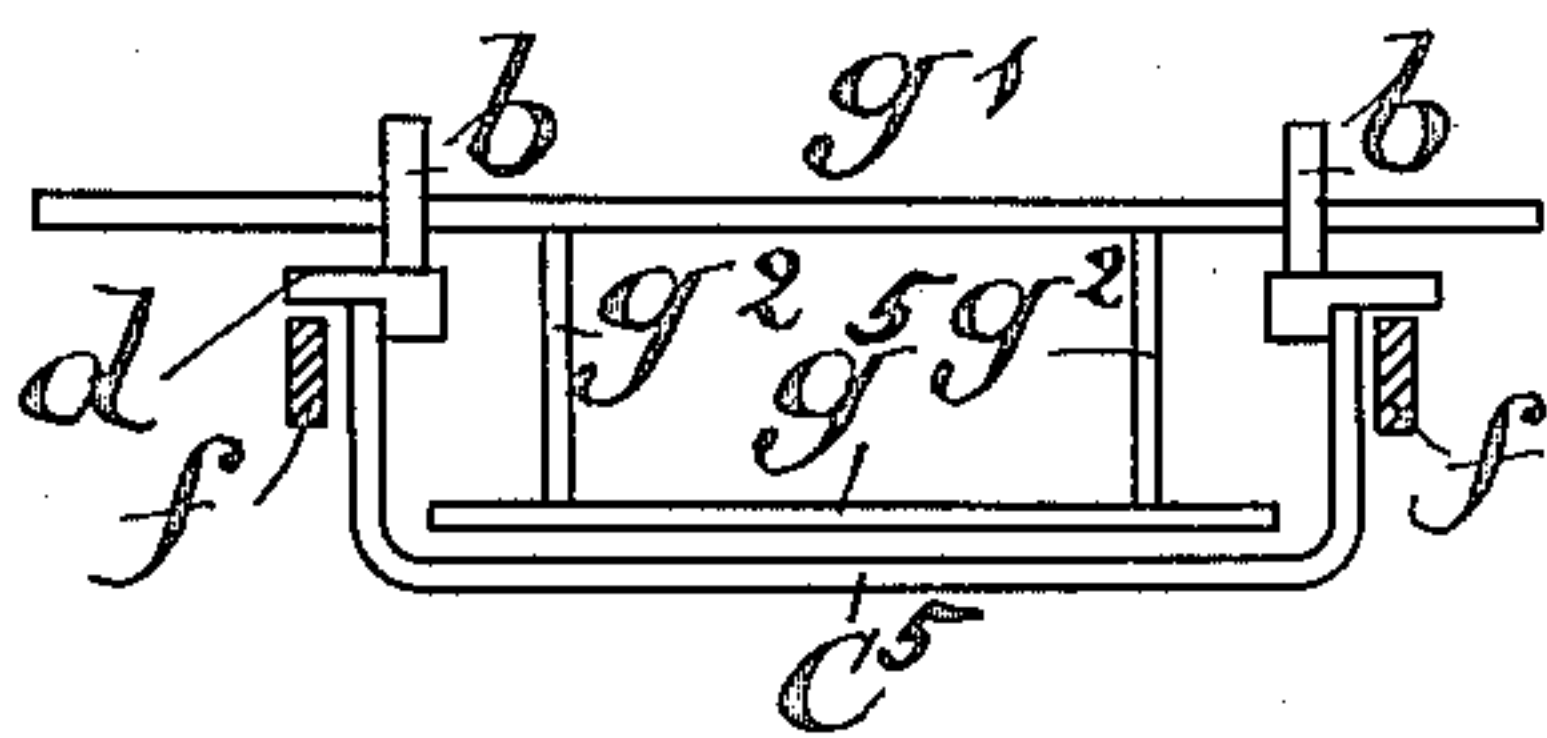
*Fig. 3*



*Fig. 4*



*Fig. 5*



witnesses:

*E. H. Bond*

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*Attorney*



# UNITED STATES PATENT OFFICE.

NILS KARL HERMAN EKELUND, OF JÖNKÖPING, SWEDEN.

## APPARATUS FOR DRYING AND CHARRING MATERIALS.

951,804.

Specification of Letters Patent. Patented Mar. 15, 1910.

Application filed September 13, 1907. Serial No. 392,724.

*To all whom it may concern:*

Be it known that I, NILS KARL HERMAN EKELUND, a subject of the King of Sweden, and resident of Östra Storgatan 13, Jönköping, in the Kingdom of Sweden, have invented certain new and useful Improvements in Apparatus for Drying and Charring Materials, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to a furnace or apparatus for drying and, if wanted, charring peat, saw-dust and other materials consisting of small pieces or in the shape of powder. The said invention is based upon the fact that the more finely divided the solid material is and the thinner the layer is, which it forms, while being heated, the more rapidly the drying operation is effected. Moreover the invention is characterized by the fact that the material is so moved, during the drying operation, that particles, situated nearest to the heat emitting surface, are removed, when heated and dried, from the surface, in order to give place to other particles before situated at a distance above the said surface, the movement of the particles being effected successively. Further, the said invention is characterized by the temperature being highest during the first moments of the drying operation, a current of fresh air being led above the material to be dried and rapidly removing the moisture, and the material being more and more finely divided during the drying operation. The said operations are effected in a furnace described below with reference to the accompanying drawings.

Figure 1 is a longitudinal, vertical section of the furnace, Fig. 2 is a cross section of the same on the line T—U of Fig. 1. Fig. 3 is a cross section of a part of the furnace on a greater scale. Fig. 4 shows a part of the bottom of the furnace on a greater scale. Fig. 5 shows a modification.

The furnace consists of a plurality of drying chambers A, A<sup>1</sup>, A<sup>2</sup> . . . of great length and located one above the other, a flue B, B<sup>1</sup>, B<sup>2</sup> . . . respectively being provided under each of the said chambers. The said chambers communicate at their right and left ends alternately through openings F, F<sup>1</sup>, F<sup>2</sup> . . . and a channel G leads from the lowermost drying chamber to a chamber or pit H, in which the material is gathered. A fireplace I is provided in the top flue, in

which peat powder preferably is used as fuel in order to produce a long flame, which heats the long drying chambers uniformly. The said flues communicate at their right and left ends alternately, in accordance with the drying chambers, through channels P, P<sup>1</sup>, P<sup>2</sup>, provided in the side walls of the chambers, and communicate at X with a chimney or suction fan removing the combustion products. One or more endless chains *a* are provided in the drying chambers longitudinally to the same and are moved by means of sprocket-wheels *b*. A kind of scraper like pieces *c*, carrying the material with them, are fixed to the said chains. The said scrapers consist of plates or the like, located edgewise and extending across the bottoms of the drying chambers. Each scraper has a lower part *c*<sup>1</sup>, like a foot piece, and a top part *c*<sup>2</sup>, connected with the former by a narrow center part *c*<sup>3</sup>. The ends of the top parts of the scrapers connected with the chains are provided with pins *d* with rollers, formed by iron tube pieces, and the said pins bear upon iron rails *f*, located at the sides of the drying chambers, which rails, consequently, form supports for the chains and the scrapers, so that the latter pass closely to the bottom of the drying chamber without being worn by the same. The top part of the scrapers may consist of a single rod, the ends of which form the pins *d*. Stationary scrapers *g* are fixed to the rails *f* at such a level above the bottom of the drying chambers, that the foot piece *c*<sup>1</sup> of the movable scrapers *c* can pass under the same. The said stationary scrapers *g* form a kind of obstacle to the material when moved forward by the traveling scrapers, and consequently determine the thickness of the layer moved forward. The chains *a* extend outside the one end wall of the furnace and are there inclosed by removable protecting iron hoods or shutters *h*, so that the chains and scrapers can be inspected, repaired etc.

The drying chambers and the flues are separated by fire-proof vaults or plates C of cast-iron, said plates resting in slots *k* in the side walls. The drying chambers are provided with channels or openings located in the vicinity of one of the end walls. Openings *n* are provided in the opposite side wall of the drying chambers with relation to the said valves and in the vicinity of the other end wall, said openings leading to a



chamber K, provided at its top with the chimney L, with a damper M and at its bottom with a suction fan N<sup>1</sup> located in a casing N. A channel R is provided above the uppermost drying chamber, extending longitudinally to a part of the same. The said channel is provided with a conveying or distributing device, no special flue being however provided under the channel. The said channel has a hopper D with two feeding rollers E. In one or more of the openings, through which the drying chambers communicate (as for instance in the openings F and F<sup>1</sup>) and in the outlet channel G, crushing rollers S are provided. A chimney O with damper O<sup>1</sup> is provided at the top of the furnace, leading from the channel R.

The described furnace operates in the following manner. The firing operation with the pulverous fuel material in the fireplace I is started. The flame and the hot combustion gases pass through the channels B, P, B<sup>1</sup>, P<sup>1</sup>... to the chimney X or the suction fan, so that the furnace is heated from its top downward and to a higher degree at the top drying chamber than in the bottom chamber. When the furnace is heated to the proper temperature the conveying chains are put in motion. The peat is fed through the hopper D into the channel R, in which the peat is uniformly distributed and put in order for the drying operation. The peat falls down through an opening on to the heated bottom C of the chamber A. The traveling scrapers c will then move the peat slowly forward along the bottom of the chamber. In front of each scraper a long heap is formed, which grows higher and higher, until its top layer touches the stationary scraper g. The said scraper will then sweep off the top layer, which falls down on to the bottom, in front of the set of the next scraper. In this manner the scrapers will continue in pushing forward the lowermost layer and keep back the top layer. When moved to the opening F<sup>1</sup> the somewhat heated peat is acted upon by the rollers S and is crushed to a finer powder. The peat is moved in the opposite direction in the drying chamber A<sup>1</sup> but in the same manner, the peat being then again crushed by the rollers in the opening F<sup>2</sup> and so on, until it arrives between the crushing rollers in the channel G, from which it falls down into the pit H in a finished condition. During the operation the fan n<sup>1</sup> has sucked the steam from all the drying chambers and accelerated the drying operation by the fresh air, which, owing to the suction, has entered the chambers through the openings m and passes over the peat. Dust like particles, which possibly accompany the peat, fall down in the chamber K. When not very wet peat is treated, the fan can be stopped very soon and the dampers of the chimneys O and

L opened, which then are substituted for the fan. If the furnace should be used for the charring of dry materials, the openings m and n and the chimney O are closed and the gases are removed through the top drying chamber. Neighboring edges of the plates C overlap each other, as shown in Fig. 4, or engage each other in any other suitable manner, so that the plates can expand or contract without permitting the peat to drop through the joints.

The described furnace may evidently be modified in many respects. As for instance the scrapers may be arranged as shown in Fig. 5. The movable scraper consists of a wide curve shaped piece c<sup>5</sup> extending across the drying chamber. The lower, straight part of the said piece is parallel with the bottom of the chamber and the parts extending upward are bent into an angle, forming the pins d. In this case the stationary scraper g<sup>5</sup> is fixed above the rails f in such manner that two arms g<sup>2</sup> extend downward from an upper rod g<sup>1</sup> or the like, which is fixed between the side walls, above the piece c<sup>5</sup> and above the lower portion of the chain, the scraper proper g<sup>5</sup> or obstacle being fixed to the said arms. There is room for the said scraper inside the curve shaped piece c<sup>5</sup>, so that the said piece can pass.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a furnace of the character described, the combination of a plurality of drying chambers one located above the other and communicating at the one end and the other alternately, endless chains in each chamber, scrapers fixed to the said chains, and moving the material on the bottom of the chamber to the opening leading to the next subjacent chamber, stationary cross pieces preventing the material from following the scrapers in a greater quantity than corresponding to the height of the scrapers, a fire-place provided at the starting point of the material passing through the furnace, and a channel extending from the said fire place, under the bottom of the said chambers for heating the same, substantially as described and for the purpose set forth.

2. In a furnace for drying and, if wanted, charring peat, saw-dust and other pulverous materials, the combination of drying chambers, located one above the other and communicating with each other, endless chains, scrapers fixed to the said chains for moving forward the material spread on the bottom of the said chambers, stationary cross pieces for retarding the uppermost particles in the layer, channels provided under the bottom of the chambers through which passes a medium heating the said bottom, openings through which the chambers communicate, and means in the said openings



for dividing the material to a still finer rate when falling through the opening to the next, subjacent chamber, substantially as described.

3. In a furnace of the character described, the combination of a plurality of drying chambers situated one above the other and communicating with each other conveying chains, provided with scrapers moving the material through the chambers, obstacles in the chambers limiting the feeding operation, channels for a medium heating the chambers, air inlets in one side wall of the chambers, a chamber K, an exhaust fan communicating with chamber K, and outlet openings in the other side wall of the chambers leading to the chamber K, substantially as described.

4. In a furnace of the character described, the combination of a plurality of drying chambers, chains, scrapers fixed to the said chains and moving the material on the bottom of the chambers, obstacles under which the material is moved, rails extending longitudinally to the chambers and supporting the said scrapers, channels for a medium heating the chambers, an air conduit in the chambers for removing the moisture, and crushing rollers between which the material is moved when passing from one chamber to the other, substantially as described.

5. In a furnace of the character described, the combination of a plurality of drying or charring chambers situated one above the other, endless chains, scrapers fixed to the same and moving the material on the bottom of the chambers, wheels around which the chains pass, and removable hoods *h* at one

end of the furnace, substantially as described and for the purpose set forth.

6. In a furnace of the character described, the combination of a plurality of drying or charring chambers, located one above the other and communicating with each other, endless chains, scrapers fixed to the said chains and moving the material forward on the bottom of the chambers, channels provided under the bottom of the uppermost heating chamber but one and the bottoms of the other subjacent heating chambers, a hopper provided with crushing rollers and leading to the uppermost chamber, and conveying means in the chamber last mentioned for moving the material to the next chamber, substantially as described and for the purpose set forth.

7. In a furnace of the character described, the combination of drying or charring chambers communicating with each other, channels for heating the said chambers, means for moving the material on the bottoms of the chambers, means for limiting the said moving operation and turning over the layer formed by the material on the said bottoms, and a conduit for an air current, and a fan for producing said air current, substantially as described and for the purpose set forth.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

NILS KARL HERMAN EKELUND.

Witnesses:

F. LANDSTEDT,  
HENRIC ENANDER.