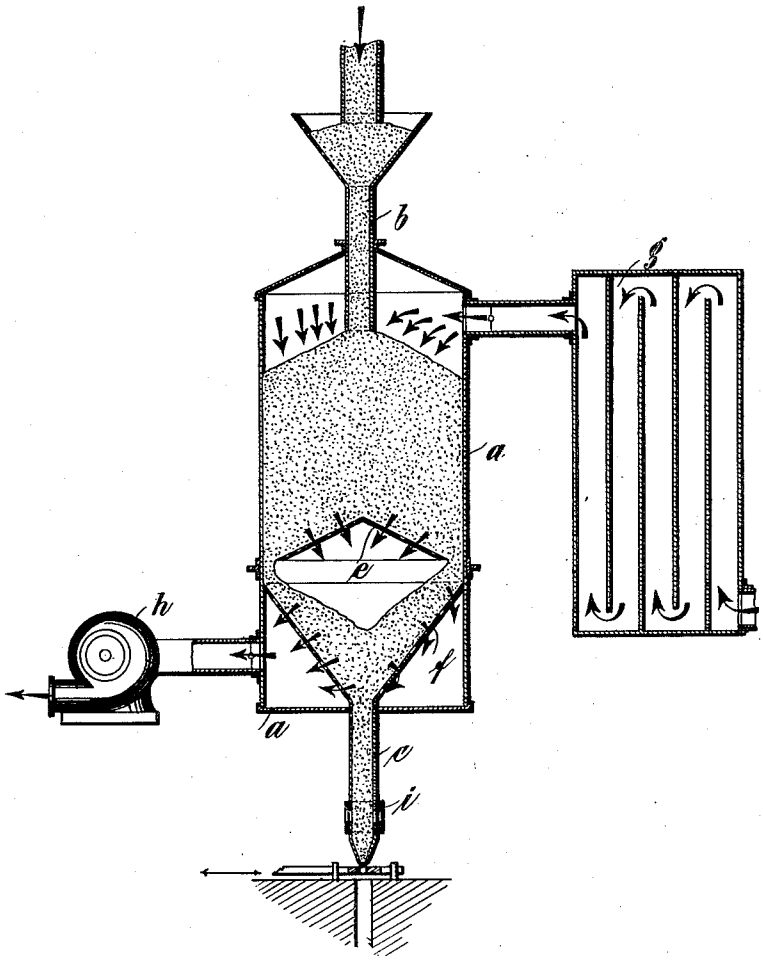
E. BORNMANN.

PROCESS FOR DRYING OR COOLING GRANULAR MATERIALS.

APPLICATION FILED OCT. 29, 1913.

1,102,714. Patented July 7, 1914.



Witnesses:
G. Schröder.
Alfred Hoffmann.

Inventor:
Ernst Bornmann

UNITED STATES PATENT OFFICE.

ERNST BORNMANN, OF ERFURT, GERMANY, ASSIGNOR TO THE FIRM OF J. A. TOPF & SOEHNE, OF ERFURT, GERMANY.

PROCESS FOR DRYING OR COOLING GRANULAR MATERIALS.

1,102,714. Specification of Letters Patent. Patented July 7, 1914.

Application filed October 29, 1913. Serial No. 798,033.

To all whom it may concern:

Be it known that I, ERNST BORNMANN, engineer, a subject of the German Emperor, residing at Erfurt, Empire of Germany, have invented certain new and useful Improvements in Processes for Drying or Cooling Granular Materials, of which the following is a specification.

The present invention relates to a process for drying or cooling granular material of the kind in which the material is treated as an unbroken uniform column in a drying tower or shaft by causing the drying medium to pass through it. Usually in such tower apparatus the drying medium passes through the material in the opposite direction to that of the movement of the material itself but it has also been proposed, in addition, to subject the portion of the material which has already been treated in this way, to the effect of a current of drying medium passing through it in the direction in which it periodically moves itself.

According to the invention, the material is treated in this kind of apparatus as an inclosed mass of uniform depth over the whole cross-section of the apparatus and it is caused to pass entirely through the apparatus in the same direction as the drying medium, as has been proposed in that type of apparatus in which the material is treated in thin layers upon sloping surfaces. In this way the heat, which is imparted to the layers of the material to be dried, upon which the drying medium first impinges, is given up in the course of the drying process to the drying medium which becomes cooled owing to its increasing saturation. This effect takes place because the drying air in the shaft-like apparatus is forced to pass completely and uniformly through all layers of the material which is fed in at the top and continues to trickle down uniformly. By this process, there is a considerably higher drying effect with a decreased consumption of heat. The material to be dried may be steadily maintained in a column the depth of which is adjustable by the use of baffles in conjunction with an adjustable feeding device, and at the same time the degree of saturation of the drying air may be adjusted. The baffles may be conical plates sloping toward the center or toward the circumference as has been employed in drying kilns in which hot air supplied from above passes radially outward through a thin annular vertical column of the material trickling down under treatment. The baffles also serve to keep the depth of the thickness of the column of material trickling down the same as above mentioned over the whole of the breadth of the apparatus so that a uniform current of air is present.

The drawing shows diagrammatically a section through an apparatus for carrying out the process according to the invention.

The material to be dried is placed in a shaft-shaped container *a* of any desired form of cross-section through any desired removable feed device *b* which is formed in the example illustrated as a removable supply tube provided with a funnel top.

The discharge of the material takes place through the outlet pipe *c* at *d*. The cross-section of the outlet at *d* can be varied through any desired means and thereby the speed of the passing out of the material and the passing in (through pipe *b*) and thereby, too, according to the period of time during which the material remains in the apparatus, the drying is controlled. A sloping baffle *e*, permeable to air, in the example illustrated as conical, promotes a symmetrical flowing movement as well as the mixing of the material to be dried. The gradient of the conical baffle *e* is made in accordance with the angle of repose of the material to be dried in order to insure that the height of the layer of the material is uniform over the whole cross-section of the apparatus so that a current of air takes place uniformly over the whole cross-section of the apparatus. In order to maintain this operation and to supply the drying air, a second conical permeable baffle *f*, arranged below the first-named, serves. By means of the baffles *e*, *f*, which may be fixed or movable, in conjunction with the adjustable feeding device *b*, the material to be dried is maintained as an inclosed mass continually uniformly trickling down, the thickness being adjustable. By adjustment of the thickness of the layer the saturation of the drying air is correspondingly adjusted. The lower part of the container *a* bounded by the baffle *f* is placed in connection with a suction air pump *h*. The drying medium (air or gas) is warmed in a heater *g* of any desired construction connected in desired manner to the drying apparatus and is drawn through the air

pump *h* in a constant stream in the same direction with the material.

The point at which the drying air passes into the container is so arranged that the air steadily acts upon the material to be dried from above, and acts particularly to constantly warm the top-most layers of the same. In these layers the drying air becomes comparatively little saturated. Its temperature and therefore also that of the material to be dried remains greater here than in the lower layers. When the material to be dried sinks down then these warmer layers re-act upon the drying air which has become cooler owing to the increasing saturation, consequently it raises its temperature and thereby it renders it capable of taking up more moisture.

In order not to interfere with the discharge of the material to be dried at the outlet *d* owing to the back pressure prevailing in the lower part of the apparatus a suitable adjustable and closable air inlet device *i* is arranged at a suitable point above the outlet, for example on the outlet pipe *c*, which device relieves the back pressure at the outlet *d*. At the same time, this brings about a cooling of the material being discharged. The apparatus can also by the same mode of operation be used conversely as a cooling apparatus.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States is:—

A process for treating granular material consisting in continuously passing material *en masse* through an inclosed column, maintaining a mass of substantially uniform depth and body during the passage of the material through the column, introducing a drying medium into the mass of material at the beginning of the travel of the mass and causing said medium to travel continuously through the mass in the direction of travel of the latter.

In testimony whereof I have affixed my signature in presence of two witnesses.

ERNST BORNMANN.

Witnesses:
GEORG SCHRÖDER,
ALFRED HOFFMANN.