E. BORNMANN.

APPARATUS FOR DRYING GRANULAR MATERIAL.

APPLICATION FILED MAR. 31, 1914.

1,155,402.

Patented Oct. 5, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

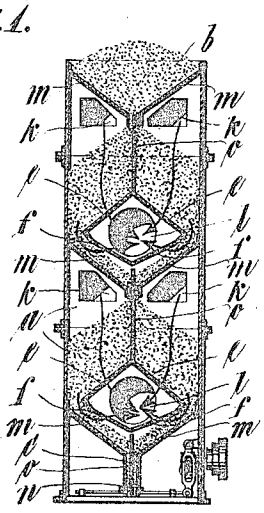
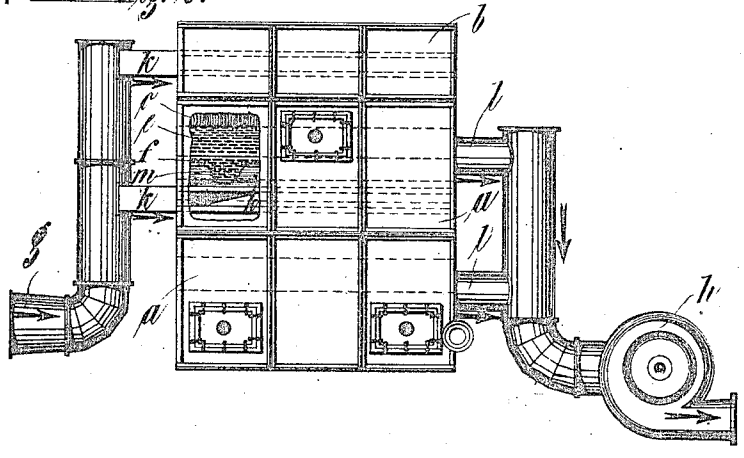


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

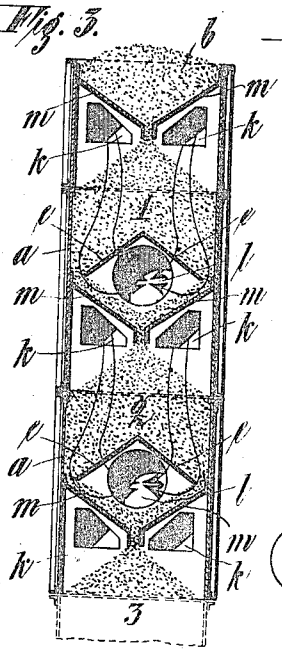


Fig. 4.

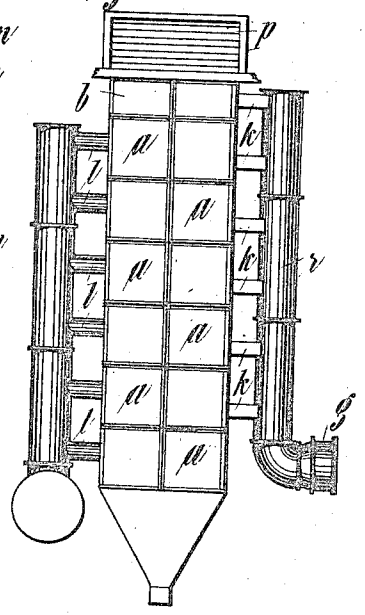
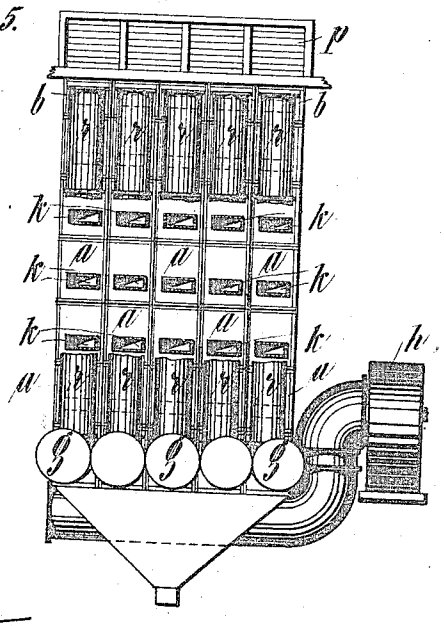


Fig. 5.



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UNITED STATES PATENT OFFICE.

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

APPARATUS FOR DRYING GRANULAR MATERIAL.

1,155,402. Specification of Letters Patent. Patented Oct. 5, 1915.

Application filed March 31, 1914. Serial No. 828,549.

To all whom it may concern:

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

This invention relates to an improvement in or modification of the invention described in the specification of my prior U. S. application of October 29, 1913, Serial Number 798033. The invention set out in that specification consists of an apparatus for drying granular material in which the material to be dried is passed as an inclosed mass through a shaft and is caused to move continually in the same direction as the drying medium, the layer of material being maintained of uniform depth over the whole cross section of the apparatus. The depth of the layer and uniformity of the column of material in the apparatus are regulated by means of baffles sloped in accordance with the angle of repose of the material in conjunction with a feeding device at the top.

This invention is modified according to the present invention in such a manner that the material passing through the apparatus is so divided that each coherent column of material always slopes away toward one side. In this way it is insured that all portions of the column of material will move uniformly through the apparatus. This is not the case, however, with the column of material, as according to the prior invention this is caused to deviate in more than one direction at the same time when it is divided up, and especially is this so when the baffles dividing up the column are not quite exactly fitted so that on one side there is more frictional resistance or less free cross section than on another side.

The accompanying drawings serve to illustrate one form of construction according to the invention.

In these drawings—Figure 1 is a vertical section, and Fig. 2 is a front view in which a part of the outer casing is cut away. Fig. 3 shows diagrammatically one form of construction according to the invention in vertical section in a larger scale, and Figs. 4 and 5 are front and side views respectively of a complete apparatus consisting of a number of columns of elements.

The construction of the apparatus is in principle the same as that of the prior invention. The material is introduced in the form of an inclosed column uniformly trickling down through an inlet *b* into a drying shaft *a* of one or more section and it passes out through an outlet *c*. In the example of construction illustrated in Fig. 1 two drying superimposed elements are contemplated which are separated by means of the baffle *m*. By this construction the air outlet *l* is disposed at a point below the baffles *e* and the latter are joined up to the baffles *f*, which in this case are opposite the baffle *m*. The supply of heating air takes place as in the prior invention through a junction *k* opening out above the upper surface of the columns.

According to the present invention, the shaft *a* is divided by a vertical partition *o* arranged in the plane of the apices of the baffles *e*, *f*, and this partition extends from the inlet to the outlet for the material. In consequence, the material runs through the apparatus in two separate coherent columns each of which passes down over only one of the sloping surfaces of the baffles *e*, *f*, that is to say, each mass of material always in one direction over each baffle. In this way each of the divided columns, and thus the whole of material passing through, runs through the apparatus and quickly without being influenced by any small differences in the cross-section of the passages through the shaft. This mode of operation is of considerable advantage, more particularly for quick, uniform drying of a large mass of material. It is at its best when, as in the example of construction illustrated, the apparatus is of rectangular shape and each sloping surface extends constantly across the whole of the sides of the apparatus. The air may be drawn from the adjacent halves of the column of material, as shown in the drawing, through a common outlet *l*, one for each complete shaft element.

For the purpose of uniformly emptying the two halves of the column and of further insuring the uniformity and smoothness of the operation of the whole apparatus, a suitably driven perforated disk *n* is connected to the outlet *c*. This removes the dry material uniformly from both halves of the shaft alternately. The rate of movement of this disk is adjustable in order to render it

possible to vary the degree of drying of the material as desired.

Each unit or element of the apparatus consists, as is seen from Figs. 1 and 3, of an outer casing *a* of preferable rectangular cross-section, as desired, but of a shape inclosed externally and provided with the necessary baffles *e*, *m* for suitably treating and conducting the material to be dried. One of these baffles, in the example illustrated the part *m*, serves for leading the material from one element to another or for the discharge of the material. Each element is, besides, provided with inlet and outlet passages *k*, *l* for air or gas, and in fact, either of these passages can serve as inlet or outlet passages for the air according to whether the apparatus is to work with the heating medium moving in the same direction as the treated material or in the opposite direction. In any case, the arrangement is such that one kind of passage of each element operates either as an air inlet or outlet for the next adjacent element. By way of example in the construction illustrated the openings *k* are designed as inlets and those *l* as outlets. In this case the air, in the case when the heating medium moves in the same direction as the treated material, takes the path indicated by arrows, that is to say, it passes out from the air inlets *k* of the element 1 (Fig. 3) by the shortest way in the element 2 below, completely through the material lying therein, and out again through the outlet *l* in this element. If the apparatus works with the drying medium passing in the opposite direction to the treated material, the path of the air is in the opposite direction to that of the arrows, so that the air first passes through the layer of material in that element to which the air inlet belongs. In this way the whole of the single elements built together, without further trouble, make up a complete apparatus. If the apparatus only consists of one unit it must be completed as regards the air opening by means of a so-called inlet box *b*, which first receives the material to be dried or to be cooled, and is mountd upon the top of each apparatus. The construction of this inlet box is mainly the same as that of one of the elements of the apparatus but is somewhat shallower than these and has no baffle *e* for the inlet of the material, it being unnecessary in this case.

Units of the apparatus of this kind, the cubic content of which is designed for a certain normal standard output, can be superimposed one upon the other in any desired number according to the output desired, and is available in the case of suitable high spaces. The elements, can, however, be arranged in rows one next to the other and simply connected together in case the conditions of the spot at which it is to be erected are better adapted for this. Therefore this apparatus places one in the position of having the choice of two apparatuses of the same output with different requirements as regards space for use according to whether there is more head space or more floor space at his disposal. Such an apparatus in columns is illustrated in Figs. 4 and 5. It consists of thirty elements which are built together in five columns each of six units; each column has an inlet box. All the inlet boxes are, by means of an equalizing container *p* which first receives the material to be led in, fed at a uniform rate and a uniform amount. The elements of each column are connected to the common air pipes *r*, *q* which can be joined themselves as desired or necessary with the main pipes.

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

1. In an apparatus for drying granular material, comprising in combination an inclosed shaft through which material is passed in a continuous column, sets of baffle plates arranged in said column to cause the material to pass through the column in sub-divisions having independent movements, division plates arranged vertically in said shaft in common alinement so as to maintain the independence of said sub-divisions in their passage from one set of baffle plates to another, and means for introducing a drying medium at various stages.

2. An apparatus for drying granular material, comprising in combination an inclosed shaft through which material is passed in a continuous column, sets of baffle plates arranged in said column to cause the material to pass through the column in sub-divisions having independent movements, division plates arranged vertically in said shaft in common alinement so as to maintain the independence of said sub-divisions in their passage from one set of baffle plates to another, means for regulating the flow of material through the shaft and means for introducing a drying medium at various stages.

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

ERNST BORNMANN.

Witnesses:
GEORG SCHRÄDER,
WILLIAM KERNER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."