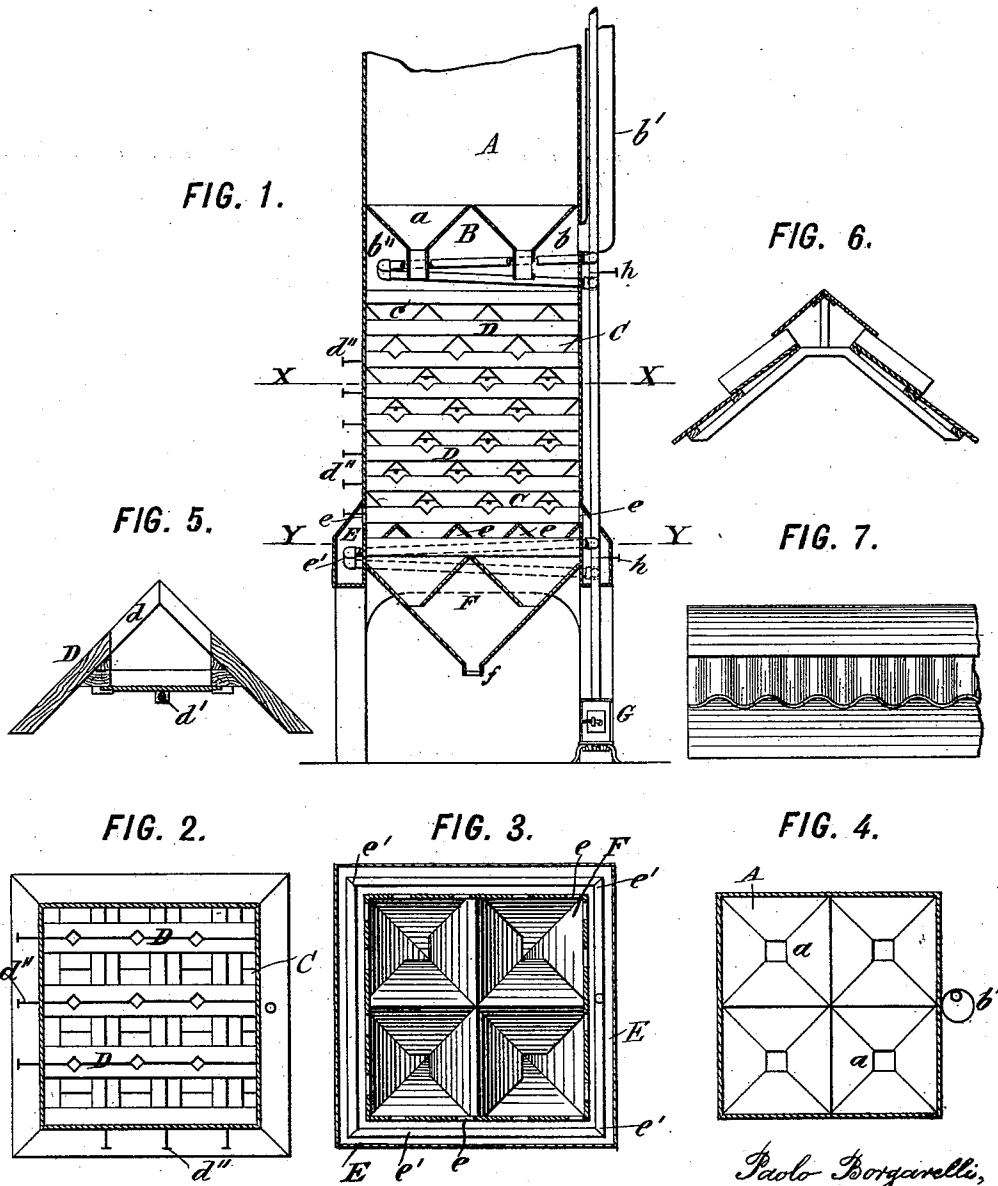


(No Model.)

P. BORGARELLI.
DRIER FOR CEREALS.

No. 469,849.

Patented Mar. 1, 1892.



WITNESSES:

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PAOLO BORGARELLI, OF TURIN, ITALY.

DRIER FOR CEREALS.

SPECIFICATION forming part of Letters Patent No. 469,849, dated March 1, 1892.

Application filed April 10, 1891. Serial No. 888,435. (No model.) Patented in Switzerland March 26, 1891, No. 3,421; in England March 28, 1891, No. 5,486; in Belgium April 15, 1891, No. 94,328; in Italy April 22, 1891, LVII, 444, and XXV, 29,315; in Spain June 26, 1891, No. 11,961, and in France July 16, 1891, No. 212,398.

To all whom it may concern:

Be it known that I, PAOLO BORGARELLI, a subject of the King of Italy, residing in Turin, Italy, have invented certain new and useful
5 Improvements in Driers for Cereals and other Divided Matters, (which invention has been patented in Italy, Vol. LVII, No. 444 and Vol. XXV, No. 29,315, dated April 22, 1891; in France, No. 212,398, dated July 16, 1891; in
10 Belgium, No. 94,328, dated April 15, 1891; in England, No. 5,486, dated March 28, 1891; in Switzerland No. 3,421, dated March 26, 1891; in Spain, No. 11,961, dated June 26, 1891,) of which the following is a specification.

15 This invention relates to driers for treating cereals or other finely-divided or granular materials and aims to provide an improved device of this character.

20 The invention relates to a novel construction of the drier whereby it works continuously and gives a complete circulation of the air or other gas used throughout the granular or finely-divided material, and is especially adapted for a desiccation and drying of cereals, either during the disinfection thereof
25 or otherwise.

30 The principal feature of my invention consists in a novel arrangement and construction of diaphragms within the treating-chamber. According to my invention these consist of superposed diaphragms constructed with oppositely-inclined sloping upper surfaces, preferably hollow on their undersides,
35 whereby they resemble inverted gutters or troughs. These are arranged in rows, superposed, and those of each row crossing those of the adjacent row and resting with their lower edges on the tops of the next lower row, whereby as the material treated descends
40 through the chamber it falls over the inclined tops of the diaphragms, while the gas in ascending will pass around the latter, thereby continually mixing said material as it traverses the chamber and effecting regular distribution of the gas throughout the mass.

45 Referring to the accompanying drawings, which illustrate the preferred form of my invention, Figure 1 is a vertical mid-section of a drier. Fig. 2 is a horizontal section thereof
50 cut on the line X X in Fig. 1. Fig. 3 is a similar section cut on the line Y Y in Fig. 1.

Fig. 4 is a horizontal section through the upper part of the apparatus. Fig. 5 is a cross-section, on a larger scale, of one of the diaphragms removed. Fig. 6 is a similar view
55 of a modified form of diaphragm, and Fig. 7 is a side elevation thereof.

The apparatus is composed of a chamber or compartment of any desired form—as rectangular or cylindrical—divided into several
60 superposed compartments.

Referring to the drawings, let A represent the receiving-chamber; C, the treating-chamber; D, the diaphragms therein; E, the gas-supplying chamber, and F the discharging
65 hopper. The upper compartment or receiving-chamber A terminates at its bottom in one or more hoppers *a a*, which conduct the material to be treated to the treating-chamber C. The space immediately below the
70 hoppers *a a* constitutes an exhaust-chamber B, which forms the upper part of the treating-chamber C, and in which the treating-gas which has traversed the latter is collected for withdrawal through an aperture *b*, which
75 communicates with a draft-chimney *b'* or with any other exhaust apparatus. The exhaust-chamber B may be warmed, if wished, by a smoke-pipe *b''* or by a steam or hot-air pipe encircling the chamber, as shown in Fig. 1;
80 or any other analogous means may be adopted for heating this chamber. The treating-chamber C contains a plurality of rows of superposed diaphragms D D, preferably formed with double inclined upper surfaces or in the
85 form of inverted gutters, forming between their edges and in their under sides spaces for the circulation of the gas and the matters to be treated. The rows of diaphragms D rest those of each row with their lower edges
90 on the tops of the next lower row. The chamber is closed at its lower end by a hopper F, which conducts the matters to be treated through one or more withdrawing-spouts *f*, by means of which the material can
95 be withdrawn as desired and in the quantities needed. Surrounding the hopper F or around the lower part of the chamber C is provided a gas-introduction chamber E, by which the gas necessary to dry the material
100 is introduced into the lower part of the chamber C through openings *e e* opposite and be-

neath the lower sides of the adjacent ends of the lower rows of diaphragms D within said chamber. The gas used enters the chamber E freely or is injected therein by a fan or by any other analogous means. It may be heated, if desired, by a smoke-pipe or steam-pipe *e'* or by any other suitable means, or, if desired, it may be heated by some physical or chemical means. One form of heating apparatus, as the stove G, is shown in Fig. 1. This can heat, if it is so desired, the chamber E or the exhaust-chamber B or the draft-chimney *b'* or the several parts together, and the heat may be distributed and regulated at will by means of suitable registers, as *h h*.

The diaphragms D of the treating-chamber C are arranged in rows, superposed and alternated in direction, those of one row crossing those of the other. The rows of the same direction are alternated in such manner that the diaphragms of the third row correspond in position with those of the first, and so on, while those of the second row cross those of the first, and those of the fourth row correspond with those of the second, as shown in Figs. 1 and 2. Preferably each diaphragm is of triangular form with the two upper sides oppositely inclined and the bottom side horizontal and open. The lower edges of each superposed row rest on the tops of the adjacent lower row, and thus all the upper rows are supported. The inclined sides may be constructed with a plain continuous surface, as shown in Fig. 5, or they may be formed of superposed overlapping strips, leaving between their overlapping edges spaces for the passage of the gas, or they may be formed as indicated in Figs. 6 and 7, wherein the superposed strips are alternately plain and corrugated, thereby leaving the series of openings corresponding to the corrugations of the corrugated strips for the air-spaces. When the diaphragms are constructed with plain inclined upper surfaces, each diaphragm may be provided at its upper part with one or more openings, as *d'* in Figs. 1, 2, and 5, which will be arranged to come immediately beneath the diaphragms of the row immediately above. These openings are provided with registers *d'*, which are opened and closed by means of valves and rods *d''*, as seen in Figs. 1, 2, and 5.

The operation of the apparatus is as follows: The cereals or other material to be treated is placed in the receiving-chamber A, from whence it passes through the hoppers *a* and into the treating-chamber C, where it is separated and regularly distributed by falling on the inclined sides of the diaphragms D D, so that as it traverses the chamber and falls from one diaphragm to another it is constantly split up into small streams. If a circulation of air within the chamber is desired, the chamber B will be put in communication with the draft-chimney *b'*, thereby drawing air from the chamber E, through chamber C and out of chamber B into the chimney *b'*. The air or other gas utilized enters the cham-

ber C through the openings *e e e* beneath the diaphragms, and is conducted by the latter and evenly distributed throughout the mass of material as it travels regularly from the bottom to the top and until it reaches the exhaust-chamber B, from whence it is withdrawn through chimney *b'*. As the drying is accomplished the material may be withdrawn through the discharge-spout *f* in the quantities desired, and then as the mass descends a quantity of material equivalent to that withdrawn may be placed in the hopper *a* and treated, in order that the amount extracted may be replaced by an equivalent amount of fresh material. One may continue charging the apparatus with material through the chamber A and withdrawing the treated material from the discharge-spout *f* when it is desired that the operation of the apparatus shall be continuous. By this device a double circulation is obtained, the gas or air going from the bottom to the top and the material to be treated from the top to the bottom. If the material, by reason of its extremely finely-divided condition or by its excessive humidity, offers too great a resistance to the circulation of the gas or air, the latter may be facilitated by opening for a short time, either partially or entirely, the registers *d'*. This will permit the air to rise directly through the interiors of the corresponding diaphragms and will diminish to that extent the thickness of the material to be traversed. When one wishes merely to dry the cereals, it will be often possible, if the outer temperature is favorable, to dispense with heating the air or gas which traverses the apparatus or to limit the heating to the chamber B for maintaining the draft; but as a general rule it will be most advantageous to heat the air or gas as it enters the drier—for example, in the chamber E. With my apparatus the drying of the cereals may be combined with their treatment with a disinfectant or an insecticide—such, for example, as are used for combating the weevil of wheat or for preparing grains intended for sowing. If the substance so employed is gaseous, it may be introduced into the apparatus mixed with ordinary air, which will serve for the drying. This can be done in the heating-chamber E or by connecting the gas-producing apparatus in any suitable manner. If the substance is volatile, its receptacles may be placed in this chamber in order to accomplish its vaporization, or this may be accomplished and the resulting gas fed to the apparatus in any well-known manner. In employing a powdered or liquid substance it is mixed in the receiving-chamber A with the material to be treated, and during the descent of the latter through the apparatus the mixture becomes very intimate and perfectly uniform, owing to the effect of the diaphragms D on the falling substance.

My invention may be variously modified without departing from its essential features, and I do not limit myself to the exact con-

struction shown and described, which is the preferred form of my invention. The form and dimensions of the apparatus, as well as the materials of which it is constructed, may be varied to suit the circumstances of the case. I may also employ any known means for feeding the matter to be treated to the chamber A and for withdrawing it from the spout f, as well as for heating the air or other gas used and for actuating or regulating the circulation.

What I claim are the following defined novel features and combinations, substantially as hereinbefore set forth, namely:

1. In a drier for treating cereals or other finely-divided or granular materials in which the material to be treated moves from the top to the bottom and which is constructed to permit a circulation of gas from the bottom to the top, the combination, with a chamber adapted to receive the material at the top and discharge it at the bottom, and means for causing an upward circulation of gas through said chamber, of a plurality of rows of superposed diaphragms arranged in said chamber and constructed with oppositely-sloping upper surfaces, the diaphragms of each row crossing those of the adjacent rows and those of each row resting with their lower edges on the tops of the next lower row, whereby as the material descends it will fall from one to

the other thereof and as the gas ascends it will pass around said diaphragms, thereby thoroughly exposing the material to the gas, substantially as shown and described.

2. In a drier or analogous apparatus for treating cereals or other finely-divided or granular materials in which the material to be treated descends and the gas ascends, the combination, with a chamber adapted to receive the material at the top and discharge it at the bottom, and means for causing an upward circulation of gas through said chamber, of a plurality of rows of hollow diaphragms, superposed, and those of each row crossing those of the adjacent row, arranged in said chamber and constructed with sloping upper surfaces and having valved intercommunicating openings, whereby as the material descends it will fall from one to the other thereof and as the gas ascends it will pass around said diaphragms or through said valved opening, as desired, thereby thoroughly exposing the material to the gas.

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

PAOLO BORGARELLI.

Witnesses:

CARLO FRANCESETTI,
SECONDO CORTA.