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CA 2862518 C 2021/03/02

(11)(21) 2 862 518

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2013/01/25
(87) Date publication PCT/PCT Publication Date: 2013/08/01
(45) Date de délivrance/Issue Date: 2021/03/02
(85) Entrée phase nationale/National Entry: 2014/07/24
(86) N° demande PCT/PCT Application No.: BR 2013/000030
(87) N° publication PCT/PCT Publication No.: 2013/110153
(30) Priorité/Priority: 2012/01/26 (BR BR 10 2012 001750 4)

(51) Cl.Int./Int.Cl. *F26B 17/12* (2006.01)
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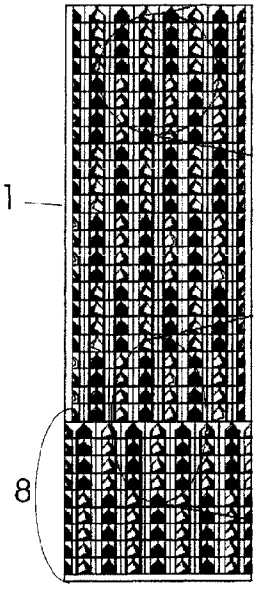
(54) Titre : SECHOIR A GRAINS A FLUX D'AIR CROISE MULTIDIRECTIONNEL DE HAUTE PRECISION SANS GRADIENTS

(54) Title: HIGH-PRECISION, MULTIDIRECTIONAL AIR CROSS-STREAM GRAIN DRIER WITHOUT GRADIENTS



(57) Abrégé/Abstract:
A high-precision, multidirectional air cross-stream grain drier without gradients comprises a continuous drier (1) with internal paths (2) for the grain stream defined between air ducts that fractionate the drying air stream, forming drying air inlets (3) and air outlets (4) arranged in parallel on either side of the grain flow paths (2) and alternating on different levels in such a manner that air streams from the right and from the left are alternatively and successively applied to the same grain stream column, along its entire path.

(12) PEDIDO INTERNACIONAL PUBLICADO SOB O TRATADO DE COOPERAÇÃO EM MATÉRIA DE PATENTES (PCT)

(19) Organização Mundial da Propriedade Intelectual
Secretaria Internacional

(43) Data de Publicação Internacional
1 de Agosto de 2013 (01.08.2013)

WIPO | PCT

(10) Número de Publicação Internacional
WO 2013/110153 A1

(51) Classificação Internacional de Patentes : *F26B 17/12* (2006.01)

(21) Número do Pedido Internacional : PCT/BR2013/000030

(22) Data do Depósito Internacional : 25 de Janeiro de 2013 (25.01.2013)

(25) Língua de Depósito Internacional : Português

(26) Língua de Publicação : Português

(30) Dados Relativos à Prioridade : BR 10 2012 001750 4
26 de Janeiro de 2012 (26.01.2012) BR

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(81) Estados Designados *(sem indicação contrária, para todos os tipos de proteção nacional existentes)* : AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,

(Continua na página seguinte)

(54) Title : HIGH-PRECISION, MULTIDIRECTIONAL AIR CROSS-STREAM GRAIN DRIER WITHOUT GRADIENTS

(54) Título : SECADOR DE GRÃOS DE FLUXO DE AR CRUZADO MULTIDIRECIONAL DE ALTA PRECISÃO SEM GRADIENTES

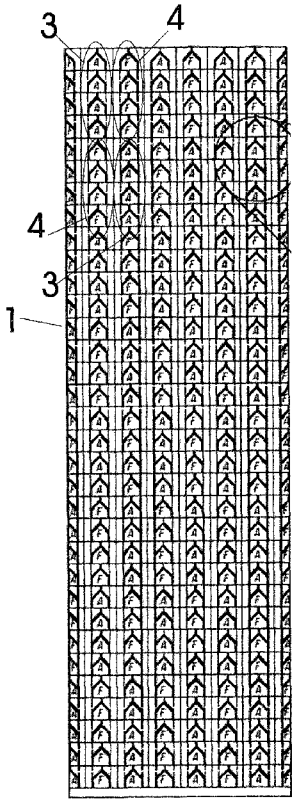

Fig.1

(57) Abstract : A high-precision, multidirectional air cross-stream grain drier without gradients comprises a continuous drier (1) with internal paths (2) for the grain stream defined between air ducts that fractionate the drying air stream, forming drying air inlets (3) and air outlets (4) arranged in parallel on either side of the grain flow paths (2) and alternating on different levels in such a manner that air streams from the right and from the left are alternatively and successively applied to the same grain stream column, along its entire path.

(57) Resumo : Secador de grãos de fluxo de ar cruzado multidirecional de alta precisão sem gradientes composto por um secador contínuo (1), provido internamente de caminhos (2) para a passagem do fluxo de grãos, definidos entre aerodutos fracionadores do fluxo de ar de secagem, constituindo entradas de ar de secagem (3) e saídas de ar (4), dispostas paralelamente em ambos os lados dos caminhos de passagem dos grãos (2), sendo distribuídas alternadamente em níveis, de modo que a mesma coluna de fluxo de grãos seja atingida alternadamente por fluxos de ar para a direita e para a esquerda e assim sucessivamente durante todo seu percurso.

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NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Estados Designados *(sem indicação contrária, para todos os tipos de proteção regional existentes)* : ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasiático (AM, AZ, BY, KG, KZ, RU, TJ, TM), Europeu (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarações sob a Regra 4.17 :

— *relativa à identidade do inventor (Regra 4.17(i))*

— *relativa à autoria da invenção (Regra 4.17(iv))*

Publicado:

— *com relatório de pesquisa internacional (Art. 21(3))*

HIGH-PRECISION, MULTIDIRECTIONAL AIR CROSS-STREAM GRAIN DRIER WITHOUT GRADIENTS

BACKGROUND OF THE INVENTION

The invention unveiled in this descriptive report pertains in a general way to the technological sector of equipments for drying grains, and refers, in a more specific way, to the sector of crossed flow dryers.

The grain drying, after harvest, is necessary to maintain the humidity in adequate levels and impede the deterioration of the stored product. There is a large variety of methods and equipments for drying grains. The continuous flow dryers are subdivided in concurrent flow dryers of countercurrent flow, dryers in cascade, and crossed flow dryers. In the dryers of concurrent flow, the drying air and the grain flow in the same direction. In dryers of countercurrent flow, the drying air and the grain flow in opposite directions. In cascade dryers, the grain moves between multiplicities of inverted troughs of V form. In crossed flow dryers, the drying air flows perpendicularly to the grains flow.

In the present state of technique, continuous grain dryings of crossed air flow have as characteristic a crossed air flow of unidirectional drying. In the entire course of the grains in the drying chamber, these receive unidirectionally the drying air flow, not existing in any moment during their residence time a change of direction of the air flow course, what causes a medium gradient of humidity (% b.u.) around eight points (comparing the smaller humidity to the larger humidity). The humidity is measured at the dryer discharge, and the gradient value can be even larger, depending of the grains' humidity at the entrance of the dryer.

In this way, conventional grain dryers of crossed air flow are deficient in results, because a fraction of the grains exists from the dryer with high humidity, and part of the grains suffers a super-drying. The grains that exit with high humidity are subject in storage to an accelerated speed of deterioration, as their intense respiration causes their death rapidly and, consequently, their deterioration. On the other hand, grains that suffered super-drying lost water in excess and suffered burning of their dry matter, losing weight and quality to be stored as well as to be industrialized.

SUMMARY OF THE INVENTION

The present invention refers to a multidirectional crossed air flow grain dryer that maintains the constructive simplicity and the low cost of a closed flow dryer; however, providing a high performance drying, without temperature gradient, and of high precision.

The proposed invention comprises fractioning air ducts of the drying air flow associated to superposed stations on their levels, which alternate air flow lines to the right or to the left, which promote the drying in one same grain flow column, intensively on its right or left entry face, always alternating the air flow course to the same grain flow column, in its entire course during their residence time.

BRIEF DESCRIPTION OF THE DRAWINGS

So that the present invention is fully understood and taken to practice by any technician of the subject, the same will be explained in a clear and objective form, with reference to the annexed drawings, which are just an example of possible concretizations of the proposed concept, without having any intention of being limitative of the scope of the protection, in which:

Figure 1: Drawing in section of a first concretization of the invention.

Figure 2: Detail in increased scale of the alternate entries and exits of air.

Figure 3: Drawing in perspective of an air flow fractioning air duct.

Figure 4: Drawing in section of a second concretization of the invention.

Figure 5: Detail in increased scale of the air entries and exits on the dryer's superior stations.

Figure 6: Detail in increased scale of the air entries and exits on the dryer's inferior stations.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention refers to a multidirectional crossed air flow grain dryer of high precision without gradients, made-up by a continuous dryer (1), provided internally of courses (2) for the grain flow passage, defined between drying air flow fractioning air ducts (3) and air

exits (4), positioned parallel on both sides of the grains passage courses (2), being alternatively distributed in levels, so that the same grains flow column is alternatively stroke by air flows to the right and to the left, and in this way successively during their entire course.

As it can be visualized in the annexed figures, the air flow lines are made-up by sets of various superposed air ducts in order to occur the equal fractioning of the drying air flow, therefore the directioning having the precision of the air injection in the entire course of the grains flow column through various passage stations.

In a concretization of the invention, the air flow fractioning air ducts are closed on their superior faces (5) and present air openings (6) only on the inferior side faces (7), which present greater extension whenever compared to the superior faces (5) (as represented in Figure 5).

In another concretization, with the purpose of eliminating any humidity gradient from the grain, the inferior stations (8) present the air flow fractioning air ducts moved to the column shafts of the superior stations grains flow (2) in order to divide the grains flow in two.

It will be clear to a technician of the subject that various modifications, variables, substitutions, and additions can be performed without escaping from the scope of the present invention, just defining different concretizations of the same inventive concept.

CLAIMS:

1. Multidirectional crossed air flow grain dryer made-up by a continuous dryer (1), internally provided with vertically straight aligned grain passage courses (2) for passage of grain flow, defined between adjacent vertically aligned drying air flow fractioning air duct columns, constituting a plurality of drying air entries (3) and a plurality of air exits (4), positioned parallel on both sides of the vertically straight aligned course (2) such that the vertically straight aligned courses (2) run continuously parallel between at least two immediately adjacent rows of drying air flow fractioning air ducts that are arranged vertically with respect to one another, characterized by the drying air entries (3) and air exits (4) being distributed alternatively in sets of various air ducts in levels and a flow column to be reached alternatively by drying air flows to the right and to the left during their entire vertically straight aligned courses (2), such that grain passing down the vertically straight courses are alternatively stroke by an air flow consisting of crossed flow air and reversed flux air.

2. Multidirectional crossed air flow grain dryer of claim 1, and also characterized by the plurality of drying air entries (3) and the plurality of air exits (4) being distributed alternatively in sets.

3. Multidirectional crossed air flow grain dryer of claim 1, and also characterized by the air flow fractioning air duct columns each being closed on their superior faces (5), and presenting air openings (6) only on their inferior side faces (7), which present larger upper and lateral extension whenever compared to the superior faces (5).

4. Multidirectional crossed air flow grain dryer of claim 1, and also characterized by inferior stations (8) alternatively presenting the air flow fractioning air duct columns moved to the vertically straight aligned course (2) of superior stations, so to divide the grains flow in two.

5. Multidirectional crossed air flow grain dryer of claim 1, wherein the air flow fractioning air duct columns are arranged in layers of parallel rows.

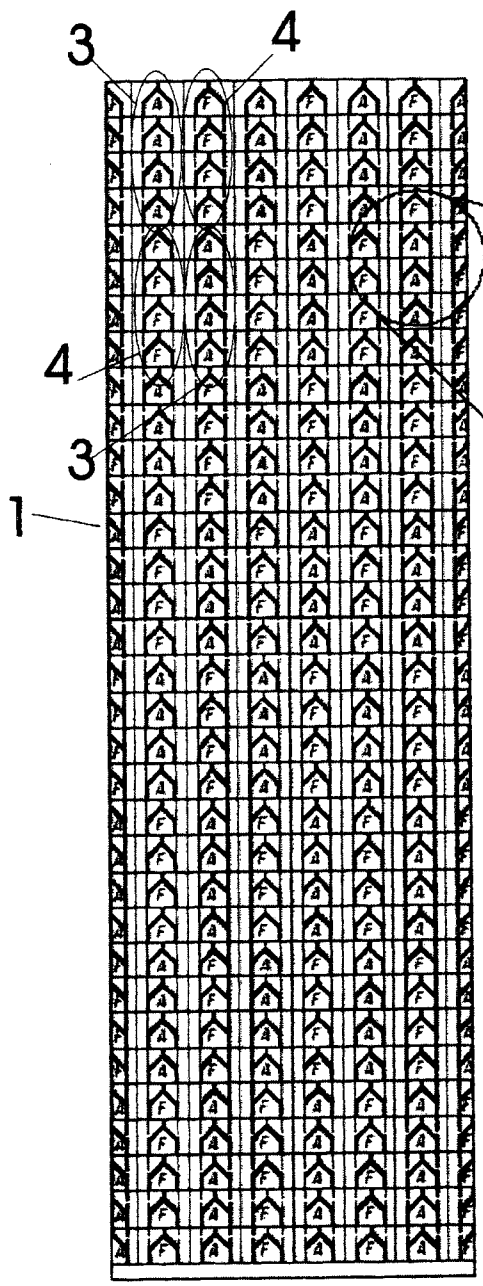


Fig.1

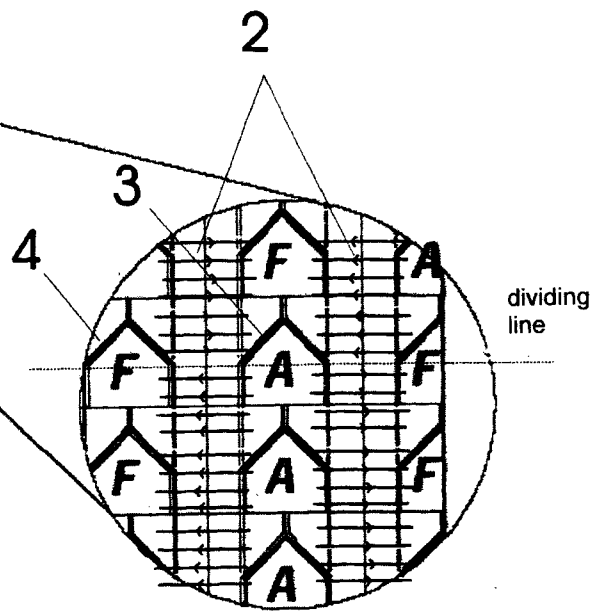


Fig.2

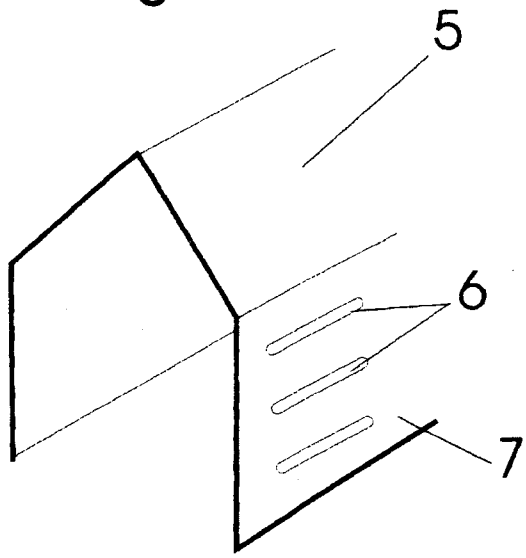


Fig.3

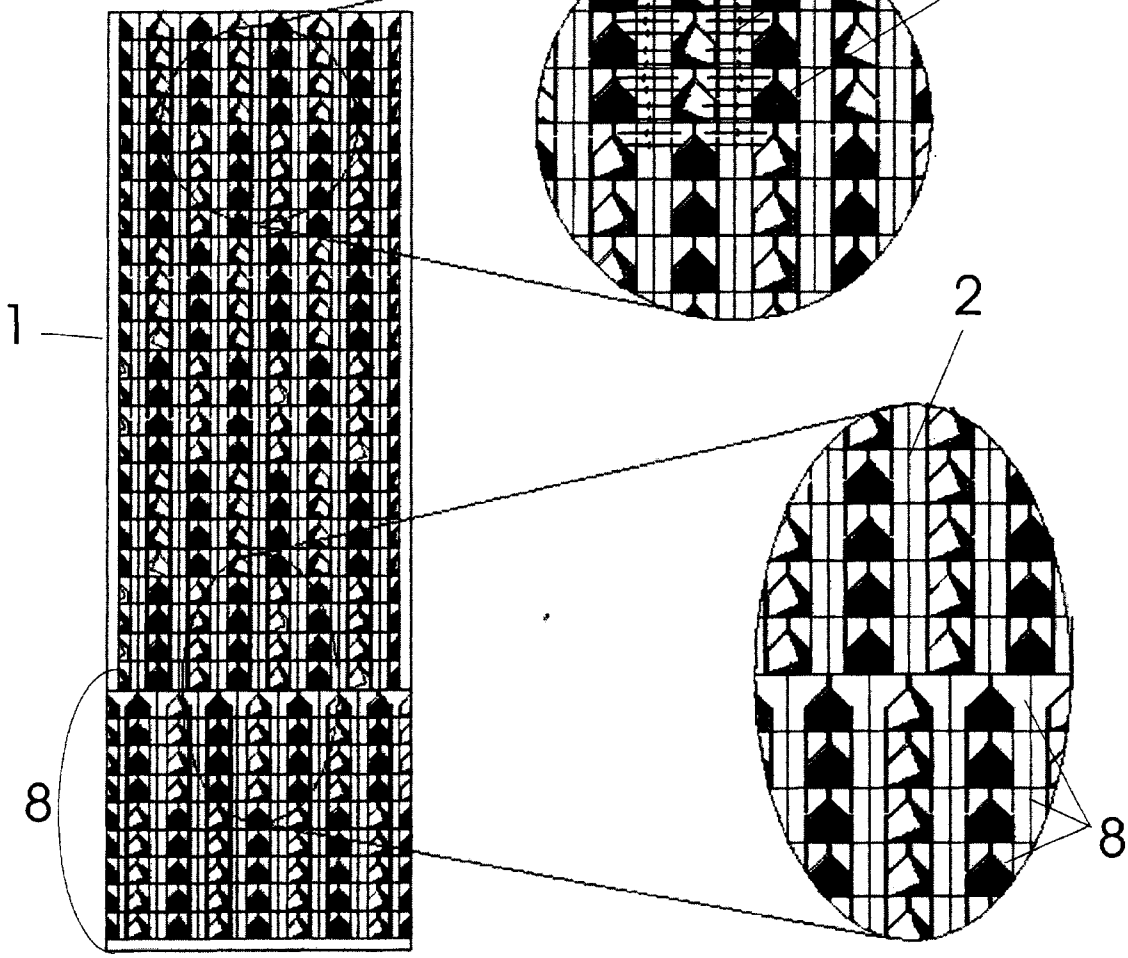
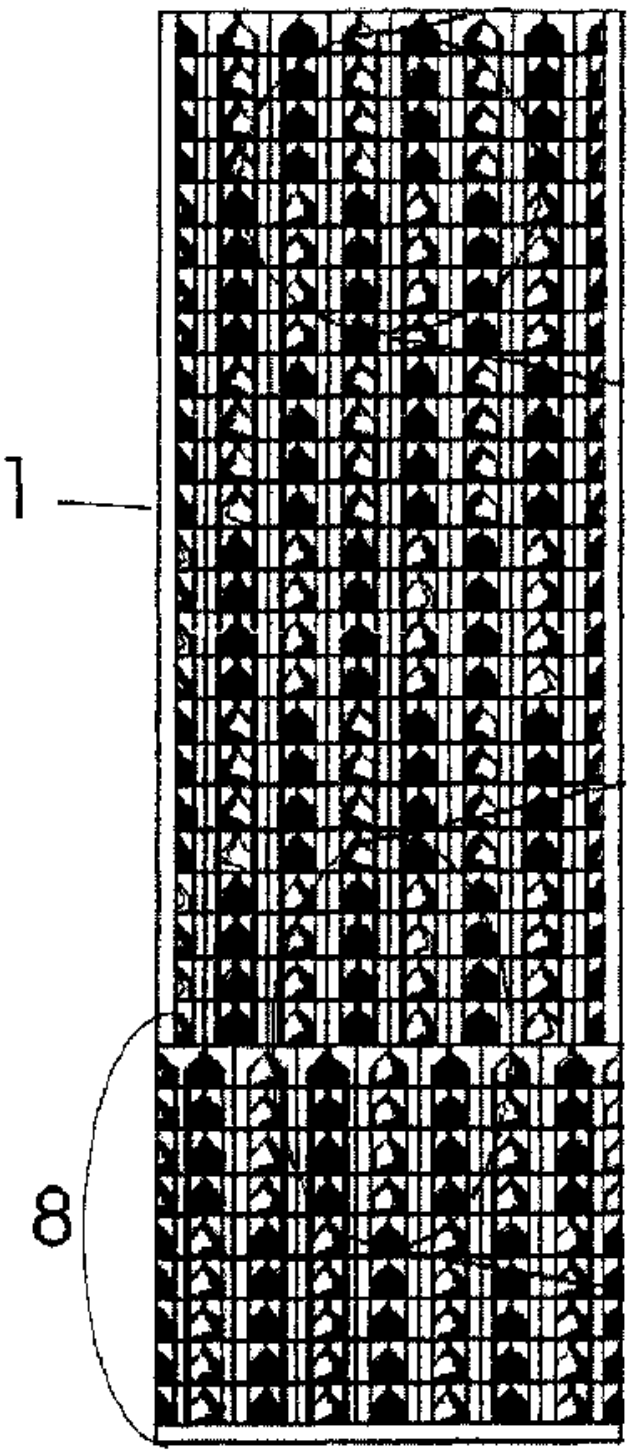


Fig.4

Fig.6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