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SCREENING DEVICE FOR THE PRODUCTION OF CALIBRATED WOOD CHIPS FOR USE IN PELLET-FUELLED BOILERS AND STOVES

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A device (1) is described for screening raw wood chips, to obtain calibrated wood chips to be used as fuel in pellet-fuelled boilers and stoves, of the type which involves the passage of flakes of these raw wood chips to be screened on elongated vibrating grates/sieves (2, 3)

subjected to vibrations and inclined to the horizontal; this device (1) includes: a first grid/sieve (2), provided with holes (2a); and a second grate/sieve (3), having a plurality of parallel channels (3a) on the bottom of which discharge openings (4, 4') are obtained.

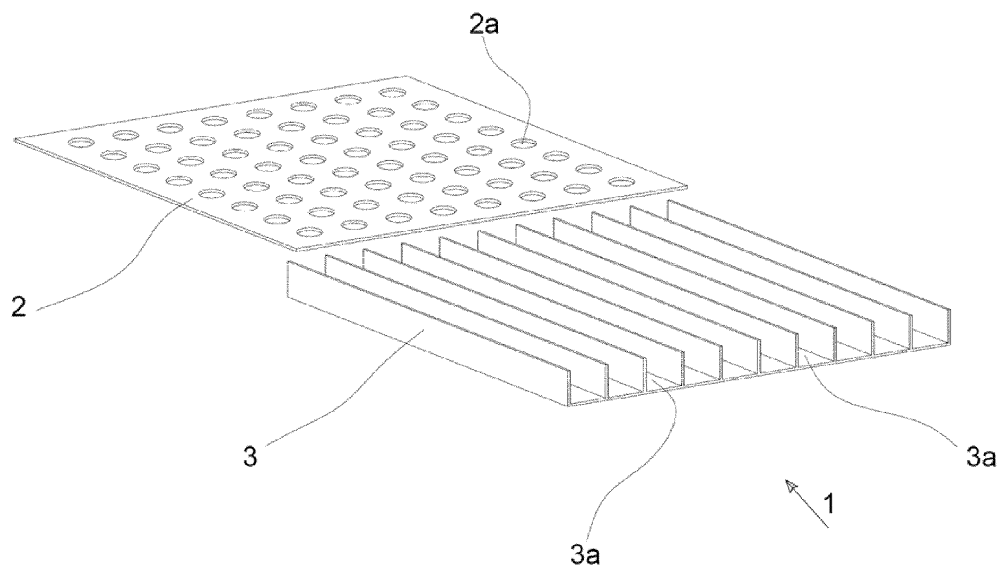


Fig. 1

Description

[0001] The present invention refers to a device for screening raw wood chips, obtained by pre-screening wood chips with a 10x10 mm grid, in order to obtain calibrated wood chips, namely of controlled dimensions, so that they are suitable for use as fuel in pellet stoves and boilers.

[0002] Through a process called "chipping", wood is mechanically chopped into small pieces called "chips" of uneven dimensions.

[0003] Raw wood chips are produced with a selected range of forestry chippers capable of producing a raw wood chip with a high percentage of calibrated wood chips (suitable for domestic stoves and boilers).

[0004] Wood transformed in this way constitutes raw wood chips, namely a plant biomass which, like pellets or firewood, is considered a 100% ecological green bio-fuel.

[0005] The calibrated wood chips, the production of which is the subject matter of the present invention, is the result of screening the raw wood chips and has a width between 3 and 12 mm, a length between 3 and 25 mm and a thickness not exceeding 7 mm, and is suitable for use as fuel in pellet boilers and stoves.

[0006] The interest in the market is enormous, considering the fact that 87% of the Italian pellet requirement is currently covered by imports from Austria, the Balkan area, Russia, Canada and New Zealand. It follows that the development of this new fuel, produced with local raw materials, will be able to contribute both to increasing the country energy self-sufficiency and to increasing the maintenance activities of the forest territory, with beneficial effects on the regulation of outflows in the forest areas and the rural economy.

[0007] It should be noted that the dimensions of the various chips are of crucial importance, otherwise blockages of the feed augers of the pellet stoves and boilers will result.

[0008] Currently, raw wood chips on the market are not intended for fuelling pellet-fuelled stoves and boilers because the problem of the dimensional non-homogeneity of the fuel has not been resolved. According to the current art, raw wood chips are mainly obtained with vibrating screens based on vibrating grids, designed to separate the smaller flakes from the wood chips.

[0009] However, current technology vibrating screens do not allow the elimination of flakes with anomalous dimensions compared to the dimensional standard of calibrated wood chips such as under- and over-measurements. The raw wood chips, generated by the current screening process of the woody material, in fact has flakes with non-uniform geometries. In particular, narrow and long flakes (width ≤ 10 mm and length ≥ 25 mm) are not eliminated with traditional screening techniques. With these sieves, the selection of the material occurs exclusively by falling into perforated elements with a known section or by crossing gratings. As a result, the elongated

wood chips (length ≥ 25 mm), which are the ones that cause the blocks in the feed screws of pellet stoves and boilers, are not totally eliminated from the mass, so raw wood chips obtained with the current screening technique are not suitable for use as a fuel to replace pellets.

[0010] Current technologies are structured for the selection of raw materials in which the selection process is carried out exclusively using grids with calibrated holes. The selection process is mainly implemented for the production of wood fibre panels in which the selection based on the diameter of the raw material and not the longitudinal dimensions is essential.

[0011] Patent CN203304177 (Shaking screener for wood chips) describes a machine of the square-disc-shaped machine body type with centrifugal advancement of material and selection by fall through a passage inside an area with calibrated holes.

[0012] Patent CN215612307 (Wood chip cleaning device for artificial board production) describes an industrial-type system for processing waste materials even in the presence of impurities. This system is equipped with sensors for the elimination of stones and metals and includes fans for the removal of plastic materials. The material is subsequently selected by falling through a passage inside an area with calibrated holes. Different dimensional typologies of materials used both for the production of wood fibre-based panels and for other applications in the construction sector are obtained.

[0013] Patent CN208407613 (Wood shavings classified screening machine) describes a machine for the selection of woody materials for the production of wooden panels from recycled materials. Up to five different dimensional types of materials are obtained by means of vibrating advancement on calibrated hole gratings.

[0014] Patent CN206953222 (Wood chip screening system with jumbo size wood chip secondary chipper) describes a composite plate production plant and refers to a wood chip screening system with calibrated hole grids and a jumbo size secondary wood chip chipper.

[0015] Patent CN108057509 (Wood chip separation device) describes a machine for the elimination of sawdust and dust from woody material and subsequent selection into two fractions. The separation occurs by gravity through a grating.

[0016] Other known screening systems are described in BR-A-9 303 968, IT-A1-2019 0000 6414, SU-A1-929 761, IT-U1-2019 0000 2115, RO-A2-129 451 and CN-A-107 984 580.

[0017] In none of the cited patents is there a system for selecting the woody material based on the length of the flakes.

[0018] Object of the present invention is selecting the so-called calibrated wood chips, that is, a woody material divided into flakes of such dimensions that they can be used as fuel in stoves and boilers currently powered by pellets. The invention is an integral part of a new production process that goes from the selection of suitable round wood for the production of calibrated wood chips, to the

choice of the most suitable forest chippers, to their optimal setting for the production of "raw wood chips" with the maximum percentage of calibrated wood chips inside, to then move on to its drying and finally to the actual screening and subsequent packaging.

[0019] The above and other objects, as will be explained below, are achieved with a device for screening raw wood chips according to claim 1. Such device, which allows the production of wood chips of controlled dimensions, so that it is suitable to be used as fuel in pellet stoves and boilers, it is of the type which involves the passage of such raw wood chips on grids/sieves inclined with respect to the horizontal and subjected to vibration, so as to guide the passage of the raw wood chips above said grids/sieves so that the flakes of said raw wood chips, of dimensions not compliant with use as fuel in boilers and pellet stoves, are separated for other uses. This device includes:

- a first grid/sieve, provided with holes, suitable for selecting the raw wood chips, eliminating dust and flakes that are too small;
- a second grid/sieve, which has a plurality of parallel channels, on the bottom of which openings are made for selecting usable flakes and for rejecting flakes that are too long.

[0020] This selection occurs following the alignment of the flakes with the prevailing dimension aligned with the direction of said channels.

[0021] Preferred embodiments and non-trivial variations of the present invention form the subject matter of the dependent claims.

[0022] It is understood that all attached claims form an integral part of this description.

[0023] The present invention solves the drawbacks in question as it allows obtaining a surrogate product for wood pellets, which can be used for the same purposes.

[0024] Currently, non-calibrated wood chips on the market are not intended for fuelling pellet stoves and boilers because the current art has not solved the problem of the dimensional inhomogeneity of the fuel.

[0025] The present invention instead guarantees the dimensional uniformity of the calibrated wood chips, eliminating all the long and uneven flakes and making the remaining flakes usable in boilers and stoves traditionally fuelled with wood pellets.

[0026] It will be immediately obvious that numerous variations and modifications can be made to what is described (for example relating to shape, dimensions, arrangements and parts with equivalent functionality) without departing from the scope of the invention, as appears from the attached claims.

[0027] The present invention will be better described by some preferred embodiments thereof, provided as a non-limiting example, with reference to the attached drawings, in which:

- FIG. 1 shows the major parts of the device according to the present invention;
- FIG. 2 shows the part of the device that carries out the final screening.

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[0028] With reference to FIG. 1, (1) designates a device for screening calibrated wood chips, namely a vibrating screen with particular elongated vibrating grids/sieves (2, 3) for screening raw wood chips.

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[0029] These grids/sieves (2, 3) have their longitudinal axis which is inclined, with respect to the horizontal, by an angle α between -15° and 30° , preferably between 0° and 15° , such that the combined effect of vibrations and gravity advances the wood chips.

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[0030] A first grid/sieve (2), provided with a plurality of holes (2a), allows the wood chips to be selected in relation to the size of the flakes. In particular, it allows eliminating dust and flakes that are too small.

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[0031] According to a preferred embodiment, such first metal grid/sieve (2), with dimensions for example 500×500 mm, is substantially a sieve with the holes (2a) with a circular section, with a diameter of approximately 3 mm, and is suitable for the elimination of dust and flakes smaller than 3 mm.

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[0032] The second grid/sieve (3), with dimensions for example 500×700 mm, has a plurality of parallel channels (3a), on the bottom of which openings (4, 4') are made for selecting and rejecting flakes that are too long.

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[0033] According to a preferred embodiment, these parallel channels (3a) have a width (or lumen) between 10 and 15 mm, preferably 12 mm, a depth of 10 mm and have a first discharge opening (4) in the terminal part and possibly a second discharge opening (4'), of a square or rectangular shape, made on the bottom of the channels (3a) themselves and with a width equal to the lumen of the channel and a length equal to 10 mm.

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[0034] The first grid/sieve (2), the one with 3-mm holes (2a), is positioned on a parallel plane, but raised by approximately 20 mm, compared to the plane of the second grid/sieve (3).

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[0035] The procedure for selecting the calibrated chips requires that raw chips (to be screened) are poured directly onto the first grid/sieve (2). The raw wood chips, due to the vibrations and inclination of the first grid/sieve (2), moves towards the second grid/sieve (3), namely the one equipped with channels (3a). The material falls from the first grid/sieve (2), onto the second grid/sieve (3), distributing itself rather uniformly among all the channels (3a), and advances due to vibrations and inclination towards the end part of the channels (3a). In the channels (3a) the wood chip is oriented with its prevailing dimension in a direction parallel to the channels (3a), so the flakes with a length of less than 25 mm fall through the discharge openings (4, 4') of the channels (3a) and they constitute the actual calibrated wood chips, while the flakes with a length exceeding 25 mm travel along the channels (3a) to the bottom, where they are collected for other energy uses.

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[0036] The sieve according to the invention preferably includes a system for unblocking wood chips along the channels (3a), represented by rotating brushes (not shown) with plastic bristles, which slide at regular intervals along the channels (3a) for the elimination of any occlusion and a system of compressed air nozzles (not shown) placed under the surface of the channels (3a) and oriented towards the discharge openings (4, 4') of the channels (3a) themselves.

[0037] The brushes will be conveniently oriented with their axis of rotation perpendicular to the channels (3a) and parallel to the plane of the second grid/sieve (3), so that the tangential speed of the ends of the bristles, at the point of contact, is parallel to the channels (3a) themselves. The direction of rotation must be such as to push the flakes in the opposite direction to the advancement direction of the material.

[0038] The compressed air, programmed regularly, removes any blockages from the openings of the channels (3a).

[0039] In summary, raw wood chips undergo a first screening through the first grid/sieve (2), which eliminates dust and pieces smaller than those of the holes (2a) (3mm). The wood chips, deprived of the smaller flakes, pass, due to vibrations and inclination, onto the second grid/sieve (3); again due to the combined effect of vibrations and inclination, the chips run along the channels (3a) of the second grid/sieve (3), with the wood chip flakes orienting themselves with the prevailing dimension in a direction parallel to the channels (3a). Once they reach the discharge openings (4, 4'), the flakes less than 25 mm long are discharged into an underlying container and constitute calibrated wood chips suitable for use in pellet stoves and boilers, while the longer flakes come out of the channels (3a) and are collected as oversized elements for other energy uses.

Claims

1. Device (1) for screening raw wood chips, suitable for obtaining calibrated wood chips, namely chips of controlled dimensions, so that they are suitable for use as fuel in pellet-fuelled boilers and stoves, of the type that provides a passage of flakes of said raw wood chips to be screened on elongated vibrating grids/sieves (2, 3) subjected to vibrations, a longitudinal axis of said grids/sieves (2, 3) being inclined with respect to the horizontal, **characterized in that** said device (1) comprises:

- a first grid/sieve (2), provided with holes (2a), suitable for selecting said raw wood chips, eliminating dust and flakes smaller than those suitable for use as fuel in pellet-fuelled boilers and stoves;
- a second grid/sieve (3), having a plurality of parallel channels (3a) on the bottom of which

first discharge openings (4) are obtained, designed to carry out a selection, by falling inside them, of the flakes suitable for use as fuel in pellet-fuelled boilers and stoves, said first exhaust openings (4) being designed to discard, preventing the fall into them, of flakes larger in size than those suitable for use as fuel in pellet-fuelled boilers and stoves, said flakes of a larger size than those suitable for use as fuel in pellet-fuelled boilers and stoves travel along the channels (3a) to their bottom, where they are collected as waste.

2. Device (1) for screening raw wood chips according to claim 1, **characterized in that** said first grid/sieve (2), suitable for selecting raw wood chips, in relation to the dimensions of the flakes of said raw wood chips, eliminating dust and flakes that are too small, is provided with holes (2a) of 3 mm in diameter.
3. Device (1) for screening raw wood chips according to claim 1, **characterized in that** said second grid/sieve (2) has dimensions of 500x700 mm.
4. Device (1) for screening raw wood chips according to claim 1, **characterized in that** a second discharge opening (4') is made in the terminal part of each of said channels (3a).
5. Device (1) for screening raw wood chips according to claim 1, **characterized in that** said channels (3a) have a lumen between 10 and 15 mm.
6. Device (1) for screening raw wood chips according to claim 5, **characterized in that** said channels (3a) have a lumen of 12 mm.
7. Device (1) for screening raw wood chips according to claim 1, **characterized in that** said discharge openings (4, 4'), made on the bottom of said channels (3a), are two discharge openings (4, 4'), rectangular or square, made on the bottom of the channels (3a) and with a width equal to the lumen of the channel and a length equal to 10 mm.
8. Device (1) for screening raw wood chips according to at least one of claims 1 to 7, **characterized in that** it comprises a system for unblocking raw wood chips along the channels (3a), composed of rotating brushes with plastic bristles plastic, which slide at regular intervals along the channels (3a) to eliminate any blockages.
9. Device (1) for screening raw wood chips according to at least one of claims 1 to 8, **characterized in that** it comprises a system for releasing wood chips from the openings (4, 4'), composed of a system of compressed air nozzles, placed under the plane of the

channels (3a) and oriented towards the openings (4, 4') of the channels (3a), so that compressed air, programmed regularly, removes any blockages.

10. Device (1) for screening raw wood chips according to at least one of claims 1 to 8, **characterized in that** said first and second grid/sieve (2, 3) are inclined by an angle α between -15° and 30° . 5

11. Device (1) for screening raw wood chips according to claim 10, **characterized in that** said first and second grid/sieve (2, 3) are inclined at an angle α between 0° and 15° . 10

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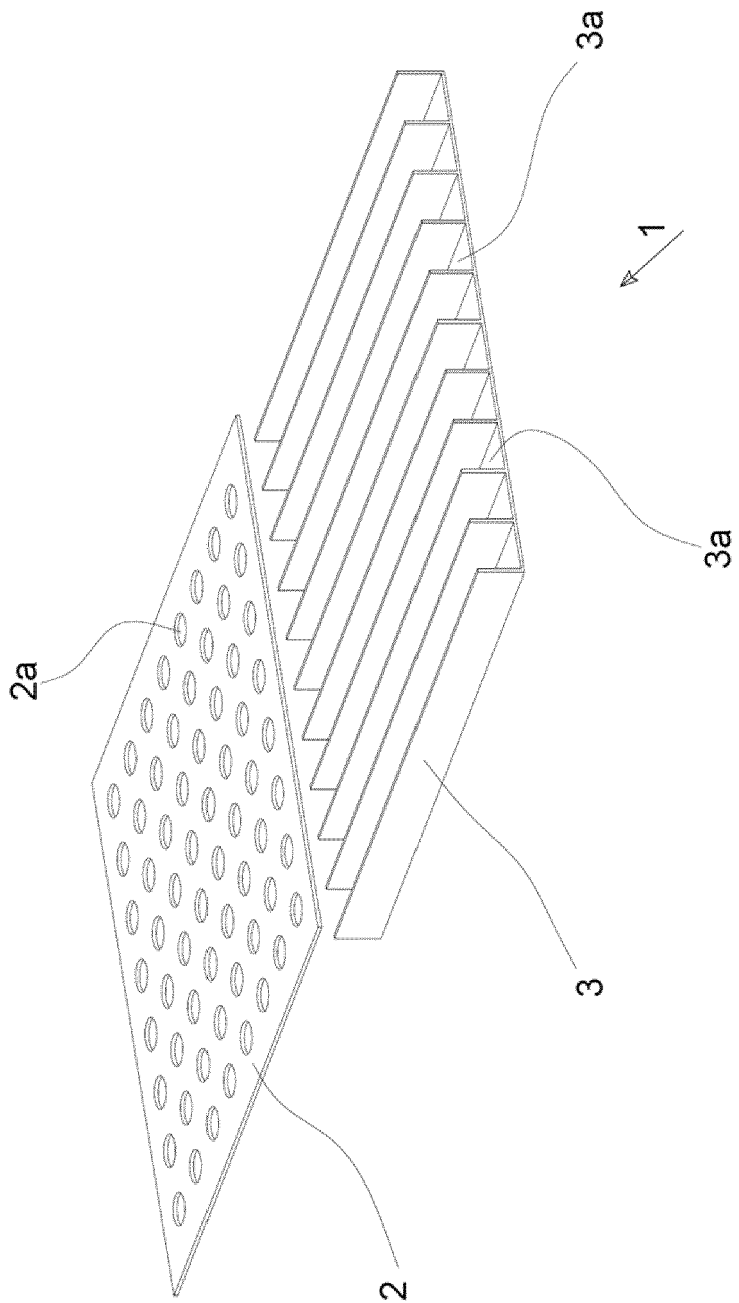


Fig. 1

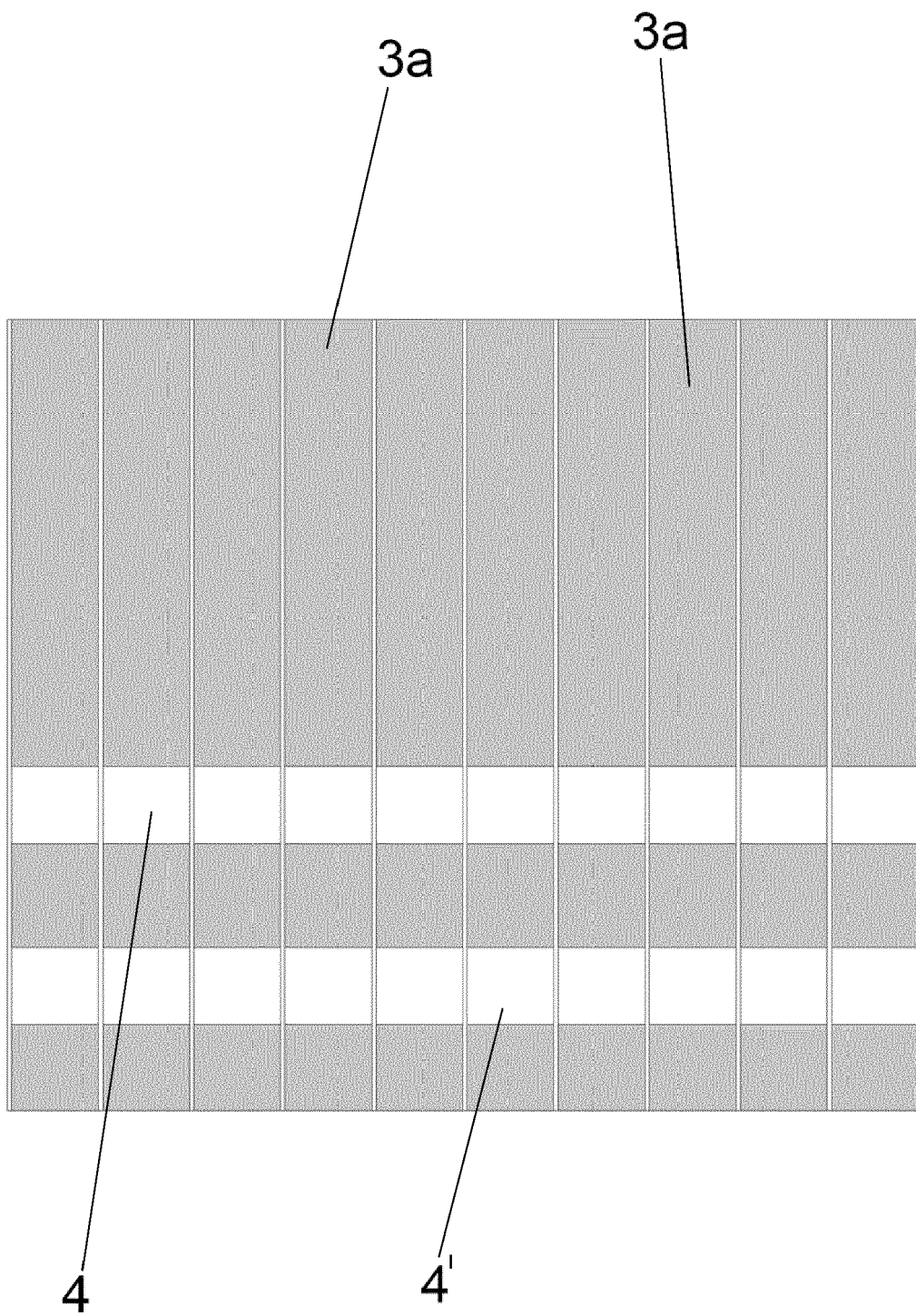


Fig. 2



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Application Number

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Place of search	Date of completion of the search	Examiner
The Hague	29 March 2024	Hamel, Pascal
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Application Number

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