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(54) **SELECTOR MACHINE TO CLEAN INCOHERENT MATERIAL, AND CORRESPONDING
SELECTION METHOD**

SORTIERERMASCHINE ZUM REINIGEN VON INKOHÄRENTEM MATERIAL UND
ENTSPRECHENDES AUSWAHLVERFAHREN

MACHINE DE SÉLECTION POUR NETTOYER UN MATÉRIAU INCOHÉRENT, ET PROCÉDÉ DE
SÉLECTION CORRESPONDANT

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a selector machine to clean incoherent material, in particular for removing polluting materials present therein.

[0002] Advantageously, but not restrictively, the polluting materials in question are of the heavy type, for example, but not only, inert materials such as stones, glass, sand, but also of a metal or plastic nature.

[0003] The polluting materials are typically associated mainly with incoherent wood-type material, for example wood shavings, wood chip, crushed wood, wood residues or similar or comparable material, which can come from any source whatsoever.

[0004] In particular, the present invention, cleaning the material by selection, allows to separate and make available the fine fractions of incoherent wood material that would otherwise be discarded.

[0005] The present invention also concerns the corresponding selection method to clean the incoherent material as above.

BACKGROUND OF THE INVENTION

[0006] It is known that the reuse of wood material, for example in the form of wood chip, is becoming increasingly important since, where possible, it allows to avoid cutting down new trees.

[0007] In particular, recovered wood, from which chips, fibers or other forms can be obtained, can be wood coming from various sources and therefore often having a high quantity of polluting materials.

[0008] For example, recovered wood can come from the processing of the wood used to obtain panels or furniture, or furnishings in general; from the recovery of packaging, pallets, bins and crates; from beams, rafters or planks or building material in general; from post-consumption, in particular waste treatment and separate collection.

[0009] It is quite evident that in the recovered wood there may be pebbles, stones, sand, metals, plastic, etc., which are all extraneous components that have to be separated from the wood so that it can be reused or recycled.

[0010] It is also known that wood chips are obtained from felled trees of various sizes that have in themselves, or are associated with, sand or small stones.

[0011] These extraneous or polluting components are normally discharged during the selection and calibration of the chip.

[0012] In particular, screening machines have been known in the state of the art for some time, designed to separate and select chips and particles on the basis of their granulometry from an incoherent or fibrous mass, whether dry or wet, generally but not exclusively of wood-based material.

[0013] Screening machines are also known which are configured to remove polluting materials, inert and not, from this incoherent mass, in order to obtain better quality wood material for subsequent processing.

[0014] These machines typically provide screens with a mesh or disc, or roller screens with one or more levels, or tiers of selection elements which define a bed onto which the material to be selected is fed.

[0015] Downstream of the screening process, it is possible that the pre-selected wood material still contains inert material that has to be removed.

[0016] For this purpose, downstream of the screening machines it is necessary to provide one or more selector machines for incoherent material to separate the wood fraction, just selected, from the inert fraction still present therein.

[0017] In particular, for cleaning the fine fractions of incoherent material, currently, these selector machines can be of the aeraulic type and are followed, or replaced, by wet-type selector machines in which separation is based on the different density of the entering materials, immersed in a fluid, generally water.

[0018] These wet-type selector machines comprise a tank containing water into which the wood material is introduced together with the inert material. Due to the difference in density, the wood material floats while the inert material falls to the bottom of the tank from which it is removed, for example, by means of a chain conveyor device. The same chain conveyor device, in the return segment, touches the surface of the water, removing the lighter wood material that is recovered and discharged to be subjected to subsequent treatments.

[0019] One of the disadvantages of wet-type selector machines is that they require a large quantity of water at entry which has to be constantly treated and periodically renewed. This not only entails a significant environmental impact, but also determines high costs for the management and procurement of the water resource.

[0020] Another disadvantage of wet-type selector machines is that, since they are preferably installed outdoors, that is, in an unprotected environment and not subject to controlled temperature regulation, they can be subject to problems of freezing which would reduce their productivity and require numerous plant shutdowns to be carried out. One solution could be to enrich the water with antifreeze products which, however, could contaminate the wood material and require a further process to remove them.

[0021] Another disadvantage is that, sometimes, the water can act as an adhesive between the fine particles of inert materials and the flakes of wood material which therefore return to the production cycle still polluted, causing problems which are already known.

[0022] Yet another disadvantage may be connected to the need, for the purposes of the subsequent reuse or recycling of the recovered wood, to remove the excess moisture contained in the wood that is discharged from the tank.

[0023] There is therefore a need to perfect a selector machine to clean incoherent material which can overcome at least one of the disadvantages of the state of the art.

[0024] In particular, one purpose of the present invention is to provide a selector machine to clean incoherent material that carries out this selection in a dry environment, that is, without the aid of separation liquids such as water, for example.

[0025] Another purpose of the present invention is to provide a selector machine to clean incoherent material which reduces the number of downstream treatment processes and operations on the separated wood material, and which therefore considerably simplifies the overall structure of the plant where it is inserted.

[0026] Another purpose of the present invention is to provide a dry selection method to clean the incoherent material, that is, without the aid of separation liquids such as water, for example.

[0027] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

[0028] Document EP 1362643 A1 discloses a selector machine according to the preamble of claim 1.

[0029] Document WO2018/211545 A1 discloses an air-type separation device.

SUMMARY OF THE INVENTION

[0030] The present invention is set forth and characterized in the independent claims. The dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0031] In accordance with the above purposes, a selector machine to clean incoherent material in particular wood-based and to eliminate inert materials contained in the incoherent material comprises a selection compartment able to receive a flow of incoherent material and in which there is a roller selection assembly configured to feed the incoherent material in a direction of feed.

[0032] The roller selection assembly comprises a plurality of rollers disposed adjacent to each other on a common lying plane.

[0033] The rollers are disposed in the direction of feed at an increasing distance one from the other defining respective discharge gaps for the passage of incoherent material selected as a function of the discharge gaps as above, so as to obtain, in the selection compartment as above, at least a first selection zone and a second selection zone.

[0034] The first selection zone and the second selection zone are disposed in sequence in the direction of feed and have different discharge gaps.

[0035] The machine as above comprises at least one collection chamber disposed below the lying plane under the second selection zone.

[0036] The collection chamber is provided with first air

introduction means configured to convey a first flow of air under pressure toward the lying plane, through the rollers.

[0037] The machine as above also comprises an air-type separation unit, disposed downstream of the roller selection assembly and configured to convey a second flow of air under pressure toward the lying plane to intercept incoherent material at exit from the roller selection assembly as above.

[0038] For this purpose, according to the invention, the air-type separation unit can deliver the second flow of air which on the one hand guarantees the separation of the wood material from the residual pollutants and on the other directs the two components, wood material and residual pollutants, toward the designated discharge zone.

[0039] This machine allows to eliminate the use of water for separating incoherent wood material and polluting material, with all the resulting advantages in terms of cost, as well as energy and environmental savings.

[0040] In addition, the separation using only air under pressure and the rollers as above completely eliminates the problem related to water freezing in the winter period, and the drying of wet wood material after it has been separated from the polluting material.

[0041] The first selection zone or the second selection zone, or both, can have selector rollers, advantageously but not exclusively, which have a conical perimeter conformation and are disposed at intervals to define an axial development consisting of a series of opposite grooves, for example in the shape of opposite Vs.

[0042] The selector rollers can have, on their perimeter, a shaped profile, advantageously but not exclusively, with a stepped conformation with an inclined connection ramp.

[0043] According to the invention and in accordance with the selection level, in the first selection zone the discharge gap between two rollers, substantially defined by the distance between the conical surfaces, advantageously but not necessarily, measured in an orthogonal direction to the surfaces themselves, has an amplitude that varies in the range of between about 0.2mm and about 3mm, preferably between about 0.5mm and about 2mm.

[0044] In this way, sand, stones, small stones, glass, metal, ceramics and other similar and comparable polluting materials whose size is comprised between about 1.2-1.5mm and about 2-2.5mm are eliminated.

[0045] The first selection zone cooperates with a feed device that is configured to supply the incoherent material to be selected continuously, or in a periodic or variable manner.

[0046] The machine comprises, below the lying plane, conveyor devices which direct the inert materials toward the designated discharge zone.

[0047] According to the invention and in accordance with the selection level, in the second selection zone the discharge gap between two rollers, substantially defined by the distance between the conical surfaces, advanta-

geously but not necessarily, measured in an orthogonal direction to the surfaces themselves, has an amplitude that varies in the range of between about 3mm and about 8mm, preferably between about 4mm and about 6mm.

[0048] The first selection zone is separated at the lower part from the second selection zone by a separator baffle, configured to direct the inert material into a zone below designated for this purpose.

[0049] The machine as above comprises, below the second selection zone, a collection chamber which, advantageously, can have valve means, for example valve means of the star type, which prevent the air from exiting downward.

[0050] In accordance with some embodiments, a selection method is provided to clean incoherent material, in particular wood-based and to eliminate inert materials contained in the incoherent material.

[0051] The method comprises:

- feeding a flow of incoherent material into the selection compartment;
- performing in dry conditions, in the selection compartment, a separation according to size of the incoherent material as above by means of the roller selection assembly lying on a lying plane and along which the incoherent material is made to advance in the direction of feed, the dry separation according to size comprising:

a first selection according to size with respect to a first maximum nominal size of the incoherent material and

a second selection according to size with respect to a second maximum nominal size of the incoherent material, greater than the first maximum nominal size,

wherein, during the second selection according to size as above, at least part of the incoherent material advancing in the direction of feed is kept in suspension along the roller selection assembly by means of a first flow of air under pressure passing through the lying plane;

- performing an aerolitic gravimetric separation which provides to intercept incoherent material, at exit from the roller selection assembly, by means of a second flow of air under pressure, determining a separation by gravity of incoherent material from heavy polluting material which was not previously removed in the separation according to size.

ILLUSTRATION OF THE DRAWINGS

[0052] These and other aspects, characteristics and advantages of the present invention will become apparent from the following description of some embodiments, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a lateral elevation view of a selector machine to clean incoherent material in accordance with the present invention.

- 5 **[0053]** To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one embodiment can conveniently be incorporated into other embodiments without further clarifications.
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DESCRIPTION OF EMBODIMENTS

- 15 **[0054]** We will now refer in detail to the possible embodiments of the invention, of which one or more examples are shown in the attached drawings. Each example is supplied by way of illustration of the invention and shall not be understood as a limitation thereof.

- 20 **[0055]** Before describing these embodiments, we must also clarify that the present description is not limited in its application to details of the construction and disposition of the components as described in the following description using the attached drawings. The present description can provide other embodiments and can be obtained or executed in various other ways. We must also clarify that the phraseology and terminology used here is for the purposes of description only, and cannot be considered as limitative.

- 25 **[0056]** A selector machine 10 to clean incoherent material in the form of chips, in particular wood-based, and to eliminate inert materials contained in the incoherent material is shown by way of example in fig. 1.

- 30 **[0057]** The machine 10 can be positioned downstream of a screening machine which has already processed a first selection of the incoherent material on the basis of its granulometry.

- 35 **[0058]** In particular, the machine 10, object of the present invention, can be positioned downstream of an air-type separation machine from which it can receive incoherent material, which has sizes comprised between about 1mm and about 10mm, which requires another separation.

- 40 **[0059]** With the term "incoherent material" here and hereafter in the description we generally mean loose material of homogeneous or non-homogeneous sizes, preferably, but not necessarily, wood-based and possibly also containing polluting material, for example, but not limited to, inert material such as sand, stones, glass and suchlike.

- 45 **[0060]** With the term "chips", here and hereafter in the description we generally mean any kind of wood type incoherent material, recycled or fresh, suitable to be selected by means of roller screens, that is, for example, wood flakes, wood fragments, forest residues, wood chips, sawdust or sawmill scraps, or suchlike.

- 50 **[0061]** With reference to fig. 1, the machine 10 comprises a selection compartment 31 able to receive a flow of incoherent material and in which there is a roller se-

lection assembly 32 configured to feed the incoherent material in a direction of feed F.

[0062] The roller selection assembly 32 comprises a plurality of rollers 11 disposed adjacent to each other on a common lying plane P.

[0063] The rollers 11 are disposed in the direction of feed F at an increasing distance from each other, defining respective discharge gaps 14, 14' for the passage of incoherent material selected as a function of the discharge gaps 14, 14', so as to obtain, in the selection compartment 31, at least a first selection zone 12 and a second selection zone 13.

[0064] In particular, here and hereafter, by discharge gap 14, 14' we mean the passage gap obtained from the distance between the lateral surfaces of two adjacent rollers 11.

[0065] The first selection zone 12 and the second selection zone 13 are disposed in sequence in the direction of feed F and have different discharge gaps 14, 14'.

[0066] The second selection zone 13 is positioned downstream of the first selection zone 12 with respect to the direction of feed F.

[0067] The rollers 11 are configured to rotate around an axis of rotation of their own.

[0068] The axes of rotation of the rollers 11 are parallel to each other and coplanar. In this way, the lying plane P is substantially horizontal.

[0069] According to some embodiments, the rollers 11 can be of a known type.

[0070] For example, the rollers 11 can have, advantageously but not exclusively, a perimeter conformation so as to define, when disposed at intervals, an axial development consisting of a series of opposite grooves, for example in the shape of opposite Vs.

[0071] The rollers 11 are rotating in the same direction and are disposed adjacent to each other to define a progressive succession of discharge gaps 14, 14' having respective amplitudes G1, G2 of desired and adjustable value.

[0072] According to some embodiments, the first amplitude G1 can be different from the second amplitude G2.

[0073] According to some embodiments, the different amplitudes G1, G2 can also be variable within the same selection zone 12, 13, for example increasing in the direction of feed F of the material to be selected.

[0074] According to some embodiments, the first selection zone 12 can have rollers 11 defining between them discharge gaps 14 that have a first amplitude G1, and the second selection zone 13 can have rollers 11 defining between them discharge gaps 14' that have a second amplitude G2 greater than the first amplitude G1.

[0075] According to some embodiments, the amplitude G1, G2 of the discharge gaps 14 can be selectively adjustable. In this way, it is possible to set the desired degree of cleaning of the incoherent material, that is, it is possible to define the size range of the inert material to be eliminated.

[0076] According to some embodiments, the first am-

plitude G1 can be variable between about 0.2mm and about 3mm, preferably between about 0.5mm and about 2mm.

[0077] According to some embodiments, the second amplitude G2 can be variable between about 3mm and about 8mm, preferably between about 4mm and about 6mm.

[0078] In this way, the polluting materials such as inert materials such as sand, stones, small stones, glass, metal, ceramic and other similar and comparable polluting materials whose size is comprised between about 1.2mm and about 2mm are eliminated in correspondence with the first selection zone 12, falling by gravity between the discharge gaps 14 defined by the rollers 11 of the first selection zone 12.

[0079] For this purpose, the machine 10 comprises a collection compartment 35 disposed below the lying plane P under the first selection zone 12 and through which the heavy polluting material, removed in the first selection zone 12, can fall by gravity.

[0080] In accordance with possible embodiments, nozzles can be installed in the collection compartment 35 to deliver a flow of air under pressure directed toward the lying plane P and configured to facilitate the separation of the lighter incoherent wood material from the heavier polluting material.

[0081] In relation to the reasonable conformation of the incoherent material to be selected, that is, whether or not a sandy component is present in it, the first selection zone 12, or one or more intermediate selection zones, if present, may not be affected by flows of air in order, for example, to allow to also remove, by gravity, the sandy component as above.

[0082] According to some embodiments, the machine 10 comprises a feed device 24, positioned above the lying plane P in communication with the selection compartment 31 in correspondence with the first selection zone 12.

[0083] The feed device 24 is configured to feed the incoherent material into the selection compartment 31, on the roller selection assembly 32.

[0084] The feed device 24 can comprise valve means 29, for example valve means 29 of the star type, which prevent air from exiting from the machine 10 while the incoherent material is being fed.

[0085] The valve means 29 allow to introduce the incoherent material in a continuous or periodic, that is, variable manner.

[0086] According to some embodiments, the machine 10 comprises, below the lying plane P, conveyor devices which direct the inert material toward the designated discharge zone.

[0087] For example, in correspondence with the discharge zone as above, the machine 10 can provide drawing devices to evacuate the inert material that is discarded continuously, or containing devices 33 which can be periodically emptied.

[0088] According to some embodiments, the first se-

lection zone 12 is separated from the second selection zone 13.

[0089] In particular, between the first selection zone 12 and the second selection zone 13 there is, disposed under the lying plane P, a separator baffle 15 configured to keep incoherent material passing through the discharge gaps 14 of the first selection zone 12 separate from incoherent material passing through the discharge gaps 14' of the second selection zone 13.

[0090] For this purpose, the separator baffle 15 is inclined with respect to the lying plane P.

[0091] According to one variant, the separator baffle 15 can also have a vertical or sub-vertical positioning.

[0092] Advantageously, fig. 1, the separator baffle 15 is substantially vertical or sub-vertical, since it is orthogonal or almost orthogonal to the lying plane P.

[0093] The separator baffle 15 is partly inserted between the last roller 11 of the first selection zone 12 and the first roller 11 of the second selection zone 13 without interfering with the movement of the rollers 11.

[0094] According to some embodiments, the separator baffle 15 can be fixed or selectively mobile in a direction parallel to the direction of feed F.

[0095] According to some embodiments, the machine 10 comprises at least one collection chamber 16 disposed below the lying plane P under the second selection zone 13.

[0096] The collection chamber 16, advantageously but not necessarily, can have valve means 17, for example valve means 17 of the star type, which prevent the air from exiting downward, but allow the evacuation of the inert material that has fallen through the discharge gaps 14'.

[0097] The collection chamber 16 is delimited laterally on one side by the separator baffle 15 and on the other by an inclined wall 30.

[0098] The inclined wall 30 delimits the roller selection assembly 32 at the lower part downstream.

[0099] The collection chamber 16 is delimited at the lower part by the valve means 17 and is open upward.

[0100] The chamber 16 directly faces, upward, the rollers 11 of the second selection zone 13 and the discharge gaps 14' defined between them.

[0101] The collection chamber 16 is provided with first air introduction means 25 configured to convey a first flow of air A1 under pressure toward the lying plane P, through the rollers 11.

[0102] The first flow of air A1 keeps in suspension the lighter incoherent material which continues to advance, while the heavy pollutants fall through the discharge gaps 14' into the collection chamber 16, from which they are evacuated through the valve means 17.

[0103] In this way, the inert materials such as sand, stones, small stones, glass, metal, ceramic and other similar and comparable polluting materials whose size is less than about 4-6mm are eliminated in correspondence with the second selection zone 13, falling by gravity between the discharge gaps 14' defined by the rollers 11

of the second selection zone 13.

[0104] According to some embodiments, the machine 10 comprises an air-type separation unit 18, disposed downstream of the roller selection assembly 32 and configured to convey a second flow of air A2 under pressure toward the lying plane P to intercept incoherent material at exit from the roller selection assembly 32.

[0105] The air-type separation unit can be positioned downstream of the last of the at least two selection zones 12, 13, that is, downstream of the lying plane P.

[0106] The second flow of air A2 allows to separate the incoherent wood material, arriving from the roller selection assembly 32, from the heavy residual pollutants that have not been previously removed.

[0107] The air-type separation unit 18 comprises one or more blowing devices 19 configured to convey the second flow of air A2 toward the incoherent material at exit from the roller selection assembly 32, in correspondence with a terminal edge 21 defined by the last roller 11 of the roller selection assembly 32.

[0108] The one or more blowing devices 19 are configured to convey the second flow of air A2 with an angle of inclination α with respect to the lying plane P between about 20° and about 60°, advantageously about 45°.

[0109] The incoherent material pushed by the second flow of air A2 follows a substantially curved trajectory, for example parabolic, with a range that depends on the weight of the material as above.

[0110] In this way, the incoherent wood material follows a longer trajectory than the heavy polluting material which substantially falls into the designated discharge zone immediately below the terminal edge 21.

[0111] According to some embodiments, the air-type separation unit 18 also comprises a separator baffle 20 positioned in correspondence with the discharge zone downstream of the roller selection assembly 32.

[0112] The separator baffle 20 divides the discharge zone into a discharge zone 23 for pollutants and a discharge zone 22 for wood material.

[0113] The discharge zone 22 for wood material is further away, with respect to the discharge zone 23 for pollutants, from the lying plane P, in a direction parallel to the direction of feed F.

[0114] For example, in correspondence with the discharge zone 22 for wood material as above, the machine 10 can provide drawing devices to evacuate the inert material discarded in a continuous manner, or containing devices 34 which can be periodically emptied.

[0115] The discharge zone 23 for pollutants can, for example, flow into the containing device 33 which collects, without separation, all the separated polluting material.

[0116] According to some embodiments, the separator baffle 20 can be mobile in order to adjust its position in a direction parallel to the direction of feed F.

[0117] In this way, it is possible to define, on each occasion and in relation to the weight of the incoherent material to be cleaned, the size of the discharge zone 23 for

pollutants and of the discharge zone 22 for wood material.

[0118] According to some embodiments, the machine 10 comprises air compression devices 26, 27 configured respectively to compress the air to be conveyed to the air introduction means 25 and to the blowing devices 19 of the air-type separation unit 18.

[0119] In accordance with possible embodiments, the same air compression device 26, 27 processes the flows of air A1, A2 both for the air introduction means 25 and also for the blowing devices 19.

[0120] However, advantageously, it is preferable to have two distinct and separate air compression devices 26, 27 that supply flows of air A1, A2 characterized by different compression coefficients or by different flow rates.

[0121] In accordance with possible embodiments, the air compression devices 26, 27 can be chosen in a group comprising a compressor or a ventilator, depending on the required compression coefficient.

[0122] According to some embodiments, the machine 10 can provide an air intake chimney 28 necessary to evacuate the flows of air A1, A2 and to maintain the pressure inside the machine 10 in equilibrium.

[0123] For this purpose, the air intake chimney 28 can be of the "aspirated" type, that is, in depression. This allows to convey the flows of air A1, A2, at exit from the air introduction means 25 and from the blowing devices 19 toward the air intake chimney 28, increasing their speed.

[0124] In accordance with possible embodiments, the air intake chimney 28 can be connected to the suction mouth of the air compression devices 26, 27.

[0125] In accordance with some embodiments, a selection method is provided to clean incoherent material, in particular wood-based, and to eliminate inert materials contained in said incoherent material.

[0126] The method comprises:

- feeding a flow of incoherent material into the selection compartment 31,
- performing in dry conditions, in the selection compartment 31, a separation according to size of the incoherent material by means of the roller selection assembly 32 lying on a lying plane P and along which the incoherent material is made to advance in the direction of feed F, the dry separation according to size comprising:

a first selection according to size with respect to a first maximum nominal size of the incoherent material, and

a second selection according to size with respect to a second maximum nominal size of the incoherent material, greater than the first maximum nominal size,

wherein, during the second selection according to size as above, at least part of the incoherent material advancing in the direction of feed F is

kept in suspension along the roller selection assembly 32 by means of a first flow of air A1 under pressure passing through the lying plane P,

- performing an aerologic gravimetric separation which provides to intercept incoherent material, at exit from the roller selection assembly 32, by means of a second flow of air A2 under pressure, determining a separation by gravity of incoherent material from heavy polluting material which was not previously removed in the separation according to size.

[0127] With particular reference to the machine 10 shown in fig. 1, the feed of the flow of incoherent material is performed by the feed device 24 which, thanks to the valve means 29, allows the metering of the incoherent material inside the selection compartment 31.

[0128] The first separation according to size occurs in correspondence with the first selection zone 12, in which the distance between the rollers 11 defines discharge gaps 14 having an amplitude G1 directly correlated to the first maximum nominal size of the incoherent material to be removed.

[0129] The second separation according to size occurs in correspondence with the second selection zone 13, in which the distance between the rollers 11 defines discharge gaps 14' having an amplitude G2, greater than the amplitude G1, directly correlated to the second maximum nominal size of the incoherent material to be removed.

[0130] In correspondence with the second selection zone 13 the air introduction means 25 deliver the first flow of air A1 under pressure through the lying plane P keeping in suspension part of the incoherent material advancing in the direction of feed F.

[0131] Subsequently, the blowing devices 19 deliver the second flow of air A2 which strikes incoherent material at exit from the roller selection assembly 32, projecting the incoherent wood material further away, in a direction parallel to the direction of feed F, with respect to the heavy polluting material that falls immediately after the terminal edge 21.

[0132] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of a selector machine of incoherent material and of the corresponding selection method, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

[0133] In the following claims, the sole purpose of the references in brackets is to facilitate reading: they must not be considered as restrictive factors with regard to the field of protection claimed in the specific claims.

Claims

1. Selector machine to clean incoherent material in particular wood-based and to eliminate inert materials contained in said incoherent material, comprising
 - a selection compartment (31) able to receive a flow of incoherent material and in which there is a roller selection assembly (32) configured to feed said incoherent material in a direction of feed (F) and comprising a plurality of rollers (11) disposed adjacent to each other on a common lying plane (P) and disposed in said direction of feed (F) at an increasing distance one from the other in said direction of feed (F) defining respective discharge gaps (14, 14') for the passage of incoherent material selected as a function of said discharge gaps (14, 14'), so as to obtain, in said selection compartment (31), at least a first selection zone (12) and a second selection zone (13) in sequence in said direction of feed (F) and having different discharge gaps (14, 14'),
 - at least one collection chamber (16) disposed below said lying plane (P) under said second selection zone (13) and the machine being further **characterised by**:
 - said at least one collection chamber being provided with first air introduction means (25) configured to convey a first flow of air (A1) under pressure toward said lying plane (P), through said rollers (11),
 - an air-type separation unit (18), disposed downstream of said roller selection assembly (32) and configured to convey a second flow of air (A2) under pressure toward said lying plane (P) to intercept incoherent material at exit from said roller selection assembly (32).
2. Machine as in claim 1, **characterized in that** discharge gaps (14) of said first selection zone (12) have a first amplitude (G1) in said direction of feed (F), and discharge gaps (14') of said second selection zone (13) have a second amplitude (G2), in said direction of feed (F), greater than said first amplitude (G1).
3. Machine as in claim 2, **characterized in that** said first amplitude (G1) is between about 0.2mm and about 3mm, preferably between about 0.5mm and about 2mm, **and in that** said second amplitude (G2) is between about 3mm and about 8mm, preferably between about 4mm and about 6mm.
4. Machine as in any claim hereinbefore, **characterized in that** a separator baffle (15) is provided between said first selection zone (12) and said second selection zone (13), disposed under said lying plane (P) and configured to keep incoherent material passing through the discharge gaps (14) of the first selection zone (12) separate from incoherent material passing through the discharge gaps (14') of the second selection zone (13).
5. Machine as in any claim hereinbefore, **characterized in that** said air-type separation unit (18) comprises one or more blowing devices (19) configured to convey said second flow of air (A2) toward incoherent material exiting from said roller selection assembly (32), in correspondence with a terminal edge (21) defined by the last roller (11) of said roller selection assembly (32).
6. Machine as in claim 5, **characterized in that** said one or more blowing devices (19) are configured to convey said second flow of air (A2) with an angle of inclination (α) with respect to said lying plane (P) between about 20° and about 60°.
7. Machine as in any claim hereinbefore, **characterized in that** said air-type separation unit (18) comprises a separator baffle (20), positioned in correspondence with a discharge zone downstream of said roller selection assembly (32), which divides said discharge zone into a discharge zone (23) for pollutants and a discharge zone (22) for wood material, said discharge zone (22) for wood material being further away, with respect to said discharge zone (23) for pollutants, from said lying plane (P), in a direction parallel to said direction of feed (F).
8. Machine as in claim 7, **characterized in that** said separator baffle (20) is mobile in order to adjust its position in a direction parallel to said direction of feed (F).
9. Machine as in any claim hereinbefore, **characterized in that** it comprises an air intake chimney (28) configured to discharge said flows of air (A1, A2) and to maintain the pressure inside the machine in equilibrium.
10. Selection method to clean incoherent material, in particular wood-based and to eliminate inert materials contained in said incoherent material, said method comprising:
 - feeding a flow of incoherent material into a selection compartment (31),
 - performing in dry conditions, in said selection compartment (31), a separation according to size of said incoherent material by means of a roller selection assembly (32) lying on a lying plane (P) and along which said incoherent ma-

terial is made to advance in a direction of feed (F), the dry separation according to size comprising:

a first selection according to size with respect to a first maximum nominal size of said incoherent material and
a second selection according to size with respect to a second maximum nominal size of said incoherent material, greater than said first maximum nominal size, said method being **characterised by**:

- keeping, during said second selection according to size, at least part of said incoherent material advancing in the direction of feed (F) in suspension along said roller selection assembly (32) by means of a first flow of air (A1) under pressure passing through the lying plane (P),
- performing an aeraulic gravimetric separation which provides to intercept incoherent material, at exit from said roller selection assembly (32), by means of a second flow of air (A2) under pressure, determining a separation by gravity of incoherent material from heavy polluting material which was not previously removed in said separation according to size.

Patentansprüche

1. Selektions-Maschine zum Reinigen von unzusammenhängendem, insbesondere auf Holz basierendem, Material und zum Eliminieren von Inert-Materialien, die in dem unzusammenhängenden Material enthalten sind, aufweisend:

- eine Selektionskammer (31), die imstande ist, einen Fluss an unzusammenhängendem Material zu empfangen, und in welcher eine Rollen-Selektionseinrichtung (32) vorliegt, die eingerichtet ist, um das unzusammenhängende Material in einer Zuführrichtung (F) zuzuführen, und die eine Mehrzahl von Rollen (11) aufweist, die benachbart zueinander in einer gemeinsamen Liegeebene (P) angeordnet sind und in der Zuführrichtung (F) mit einem ansteigenden Abstand voneinander in der Zuführrichtung (F) angeordnet sind, sodass jeweilige Auslasslücken (14, 14') für den Durchgang von unzusammenhängendem Material definiert sind, das selektiert wird in Abhängigkeit von den Auslasslücken (14, 14'), sodass in der Selektionskammer (31) zumindest eine erste Selektionszone (12) und

eine zweite Selektionszone (13) nacheinander in der Zuführrichtung (F) erzielt sind, die unterschiedliche Auslasslücken (14, 14') haben,
- wenigstens eine Sammelkammer (16), die unter der Liegeebene (P) unter der zweiten Selektionszone (13) angeordnet ist, wobei die Maschine ferner **gekennzeichnet ist**:

- **dadurch**, dass die wenigstens eine Sammelkammer mit ersten Luftzufuhrmitteln (25) versehen ist, die eingerichtet sind, um einen ersten unter Druck stehenden Luftstrom (A1) zu der Liegeebene (P) durch die Rollen (11) hindurch zu fördern,
- **durch** eine Lufttyp-Separationseinheit (18), die stromabwärts von der Rollen-Selektionseinrichtung (32) angeordnet ist und eingerichtet ist, um einen zweiten unter Druck stehenden Luftstrom (A2) zu der Liegeebene (P) hin zu fördern, um unzusammenhängendes Material am Ausgang von der Rollen-Selektionseinrichtung (32) abzuscheiden.

2. Maschine gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Auslasslücken (14) der ersten Selektionszone (12) eine erste Weite (G1) in der Zuführrichtung (F) haben und die Auslasslücken (14') der zweiten Selektionszone (13) eine zweite Weite (G2) in der Zuführrichtung (F) haben, die größer als die erste Weite (G1) ist.

3. Maschine gemäß Anspruch 2, **dadurch gekennzeichnet, dass** die erste Weite (G1) zwischen etwa 0,2 mm und etwa 3 mm ist, bevorzugt zwischen etwa 0,5 mm und etwa 2 mm, und dass die zweite Weite (G2) zwischen etwa 3 mm und etwa 8 mm ist, bevorzugt zwischen etwa 4 mm und etwa 6 mm.

4. Maschine gemäß irgendeinem vorigen Anspruch, **dadurch gekennzeichnet, dass** eine Separator-Trennwand (15) zwischen der ersten Selektionszone (12) und der zweiten Selektionszone (13) bereitgestellt ist, die unter der Liegeebene (P) angeordnet ist und die eingerichtet ist, um unzusammenhängendes Material, dass durch die Auslasslücken (14) der ersten Selektionszone (12) hindurchgeht, von unzusammenhängendem Material, das durch die Auslasslücken (14') der zweiten Selektionszone (13) hindurchgeht, separat zu halten.

5. Maschine gemäß irgendeinem vorigen Anspruch, **dadurch gekennzeichnet, dass** die Lufttyp-Separationseinheit (18) eine oder mehrere Blasvorrichtungen (19) aufweist, die eingerichtet sind, um den zweiten Luftstrom (A2) zu dem unzusammenhängenden Material hin zu fördern, das die Rollen-Selektionseinrichtung (32) verlässt, korrespondierend

mit einem Endrand (21), der von der letzten Rolle (11) der Rollen-Selektionseinrichtung (32) definiert wird.

6. Maschine gemäß Anspruch 5, **dadurch gekennzeichnet, dass** die eine oder die mehreren Blasvorrichtungen (19) eingerichtet sind, um den zweiten Luftstrom (A2) mit einem Neigungswinkel (α) bezüglich der Liegeebene (P) zwischen etwa 20° und etwa 60° zu fördern. 5
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7. Maschine gemäß irgendeinem vorigen Anspruch, **dadurch gekennzeichnet, dass** die Lufttyp-Separationseinheit (18) eine Separations-Trennwand (20) aufweist, die korrespondierend mit einer Auslasszone stromabwärts von der Rollen-Selektionseinrichtung (32) positioniert ist und welche die Auslasszone in eine Auslasszone (23) für Verschmutzungen und eine Auslasszone (22) für Holzmaterial unterteilt, wobei die Auslasszone (22) für Holzmaterial bezüglich der Auslasszone (23) für Verschmutzungen in einer Richtung parallel zu der Zuführrichtung (F) weiter weg von der Liegeebene (P) ist. 15
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8. Maschine gemäß Anspruch 7, **dadurch gekennzeichnet, dass** die Separator-Trennwand (20) bewegbar ist, um ihre Position in einer Richtung parallel zur Zuführrichtung (F) einzustellen. 30

9. Maschine gemäß irgendeinem vorigen Anspruch, **dadurch gekennzeichnet, dass** sie einen Einlassschacht (28) aufweist, der eingerichtet ist, um die Luftströme (A1, A2) auszulassen und den Druck im Inneren der Maschine im Gleichgewicht zu halten. 35

10. Selektionsverfahren zum Reinigen von unzusammenhängendem, insbesondere auf Holz basierendem, Material und zum Eliminieren von Inert-Materialien, die in dem unzusammenhängenden Material enthalten sind, wobei das Verfahren aufweist: 40
 - Zuführen eines Flusses von unzusammenhängendem Material in eine Selektionskammer (31), 45
 - Durchführen in Trockenzuständen in der Selektionskammer (31) einer Separation gemäß der Größe des unzusammenhängenden Materials mittels einer Rollen-Selektionseinrichtung (32), die in einer Liegeebene (P) liegt und entlang welcher das unzusammenhängende Material in einer Zuführrichtung (F) vorgerückt wird, wobei die Trocken-Separation gemäß der Größe aufweist: 50

eine erste Selektion gemäß der Größe bezüglich einer ersten maximalen nominalen Größe des unzusammenhängenden Mate-

rials und

eine zweite Selektion gemäß der Größe bezüglich einer zweiten maximalen nominalen Größe des unzusammenhängenden Materials, die größer als die erste maximale nominale Größe ist, wobei das Verfahren **gekennzeichnet ist durch:**

- Halten, während der zweiten Selektion gemäß der Größe, wenigstens eines Teils des unzusammenhängenden Materials, das in der Zuführrichtung (F) vorrückt, in Aufschiebung entlang der Rollen-Selektionseinrichtung (32) mittels eines ersten unter Druck stehenden Luftstroms (A1), der **durch** die Liegeebene (P) hindurchgeht,
- Durchführen einer Luft-gravimetrischen-Separation, welche bereitstellt, das unzusammenhängende Material am Ausgang von der Rollen-Selektionseinrichtung (32) abzuscheiden mittels eines zweiten unter Druck stehenden Luftstroms (A2), Verursachen einer Separation via Gravität des unzusammenhängenden Materials von schwerem verschmutzendem Material, welches vorausgehend nicht in der Separation gemäß der Größe entfernt wurde.

Revendications

1. Machine de sélection pour nettoyer un matériau incohérent, en particulier à base de bois, et pour éliminer des matériaux inertes contenus dans ledit matériau incohérent, comprenant 35
 - un compartiment de sélection (31) apte à recevoir un flux de matériau incohérent et dans lequel se trouve un ensemble de sélection à rouleaux (32) configuré pour alimenter ledit matériau incohérent dans une direction d'alimentation (F) et comprenant une pluralité de rouleaux (11) disposés adjacents les uns aux autres sur un plan de couchage commun (P) et disposés dans ladite direction d'alimentation (F) à une distance croissante les uns par rapport aux autres dans ladite direction d'alimentation (F) définissant des intervalles de décharge respectifs (14, 14') pour le passage du matériau incohérent sélectionné en fonction desdits intervalles de décharge (14, 14'), de manière à obtenir, dans ledit compartiment de sélection (31), au moins une première zone de sélection (12) et une seconde zone de sélection (13) en séquence dans ladite direction d'alimentation (F) et présentant des in-

tervalles de décharge différents (14, 14'),
 - au moins une chambre de collecte (16) disposée sous ledit plan de couchage (P) en dessous de ladite seconde zone de sélection (13) et la machine étant en outre **caractérisée par** :

- ladite au moins une chambre de collecte étant pourvue de premiers moyens d'introduction d'air (25) configurés pour transporter un premier flux d'air (A1) sous pression vers ledit plan de couchage (P), à travers lesdits rouleaux (11),
- une unité de séparation de type à air (18), disposée en aval dudit ensemble de sélection de rouleau (32) et configurée pour transporter un second flux d'air (A2) sous pression vers ledit plan de couchage (P) afin d'intercepter un matériau incohérent à la sortie dudit ensemble de sélection à rouleaux (32).

2. Machine selon la revendication 1, **caractérisée en ce que** les intervalles de décharge (14) de ladite première zone de sélection (12) présentent une première amplitude (G1) dans ladite direction d'alimentation (F), et les espaces de décharge (14') de ladite seconde zone de sélection (13) présentent une seconde amplitude (G2), dans ladite direction d'alimentation (F), supérieure à ladite première amplitude (G1).
3. Machine selon la revendication 2, **caractérisée en ce que** ladite première amplitude (G1) est comprise entre environ 0,2 mm et environ 3 mm, de préférence entre environ 0,5 mm et environ 2 mm, et **en ce que** ladite seconde amplitude (G2) est comprise entre environ 3 mm et environ 8 mm, de préférence entre environ 4 mm et environ 6 mm.
4. Machine selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'un** déflecteur de séparation (15) est prévue entre ladite première zone de sélection (12) et ladite seconde zone de sélection (13), disposé en dessous dudit plan de couchage (P) et configuré pour maintenir un matériau incohérent passant à travers les intervalles de décharge (14) de la première zone de sélection (12) séparé du matériau incohérent passant à travers les intervalles de décharge (14') de la seconde zone de sélection (13).
5. Machine selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ladite unité de séparation de type à air (18) comprend un ou plusieurs dispositifs de soufflage (19) configurés pour transporter ledit second flux d'air (A2) vers un matériau incohérent sortant dudit ensemble de sélection à rouleaux (32), en correspondance avec un

bord terminal (21) défini par le dernier rouleau (11) dudit ensemble de sélection à rouleaux (32).

6. Machine selon la revendication 5, **caractérisée en ce que** lesdits un ou plusieurs dispositifs de soufflage (19) sont configurés pour transporter ledit second flux d'air (A2) avec un angle d'inclinaison (α) par rapport audit plan de couchage (P) compris entre environ 20° et environ 60°.
7. Machine selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ladite unité de séparation de type à air (18) comprend un déflecteur de séparation (20), positionné en correspondance avec une zone de décharge en aval dudit ensemble de sélection à rouleaux (32), qui divise ladite zone de décharge en une zone de décharge (23) pour des polluants et une zone de décharge (22) pour des matériaux en bois, ladite zone de décharge (22) pour les matériaux en bois étant plus éloignée, par rapport à ladite zone de décharge (23) pour les polluants, dudit plan de couchage (P), dans une direction parallèle à ladite direction d'alimentation (F).
8. Machine selon la revendication 7, **caractérisé en ce que** ledit déflecteur de séparation (20) est mobile afin d'ajuster sa position dans une direction parallèle à ladite direction d'alimentation (F).
9. Machine selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'elle** comprend une cheminée d'admission d'air (28) configurée pour évacuer lesdits flux d'air (A1, A2) et pour maintenir la pression à l'intérieur de la machine en équilibre.
10. Procédé de sélection pour nettoyer un matériau incohérent, en particulier à base de bois, et pour éliminer des matériaux inertes contenus dans ledit matériau incohérent, ledit procédé comprenant les étapes consistant à
 - alimenter un flux de matériau incohérent jusque dans un compartiment de sélection (31),
 - effectuer dans des conditions sèches, dans ledit compartiment de sélection (31), une séparation en fonction de la taille dudit matériau incohérent au moyen d'un ensemble de sélection à rouleaux (32) situé sur un plan de couchage (P) et le long duquel ledit matériau incohérent est amené à avancer dans une direction d'alimentation (F), la séparation à sec en fonction de la taille comprenant :
 - une première sélection en fonction de la taille par rapport à une première taille nominale maximale dudit matériau incohérent, et
 - une seconde sélection en fonction de la

taille par rapport à une seconde taille nominale maximale dudit matériau incohérent, supérieure à ladite première taille nominale maximale,

ledit procédé étant **caractérisé par** les étapes consistant à :

- maintenir, lors de ladite seconde sélection en fonction de la taille, au moins une partie dudit matériau incohérent avançant dans la direction d'alimentation (F) en suspension le long dudit ensemble de sélection de rouleaux (32) au moyen d'un premier flux d'air (A1) sous pression passant par le plan de couchage (P),
- effectuer une séparation gravimétrique aéraulique qui prévoit d'intercepter un matériau incohérent, à la sortie dudit ensemble de sélection à rouleaux (32), au moyen d'un second flux d'air (A2) sous pression, déterminant une séparation par gravité d'un matériau incohérent à partir d'un matériau polluant lourd qui n'a pas été préalablement retiré dans ladite séparation en fonction de la taille.

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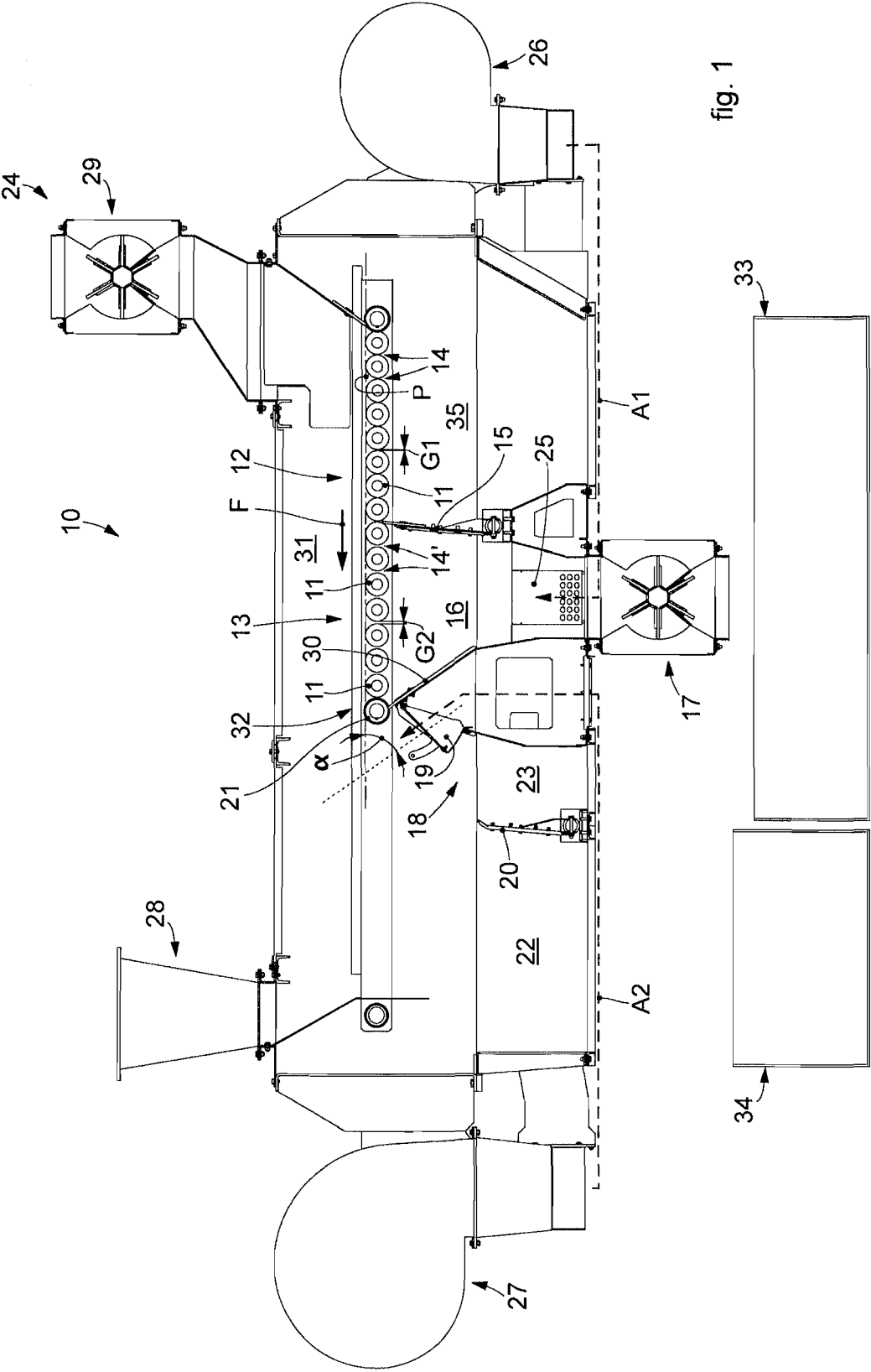
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REFERENCES CITED IN THE DESCRIPTION

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