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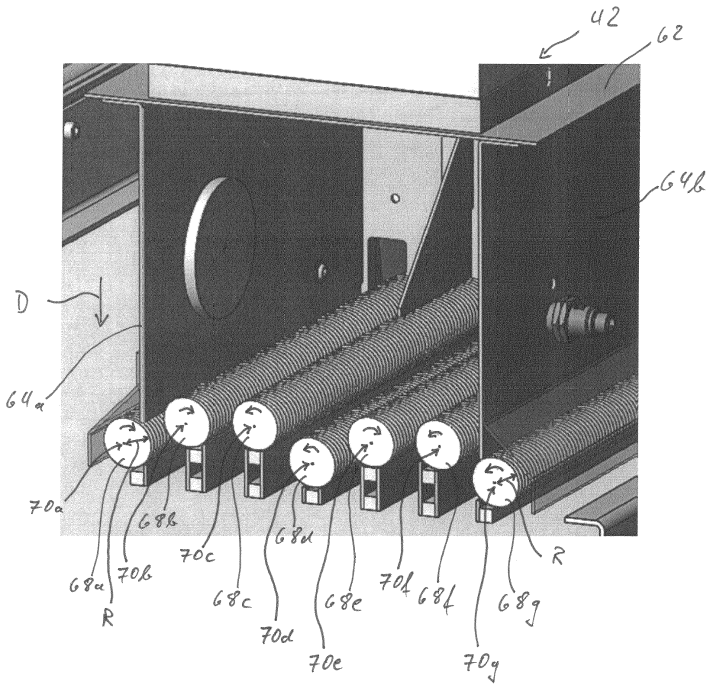
(54) APPARATUS FOR ALIGNMENT OF WASTE CIGARETTES AND METHOD OF ALIGNING WASTE CIGARETTES

(57) The invention relates to an apparatus (42) for alignment of waste cigarettes (2) and to a method of aligning waste cigarettes (2). The apparatus (42) for alignment of waste cigarettes (2) with or without filter has an inlet (60) for the waste cigarettes (2) at an upper side of the apparatus (42) and an outlet (38) for aligned waste cigarettes (2) at a lower side of the apparatus (42). Furthermore, the apparatus (42) comprises a plurality cylindrical rolls (68a-68g), each having an axis (70a-70g) of rotation being aligned substantially parallel to each other. The apparatus (42) also comprises a drive unit (72) being configured for rotating the rolls (68a-68g) about their axis (70a-70g) of rotation, wherein there is a gap (78) between neighbouring rolls (68a-68g), the gap (78) having a width which allows the waste cigarettes (2) to be conveyed through the gap (78).

Fig. 3



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Description

[0001] The invention relates to an apparatus for alignment of waste cigarettes and to a method of aligning waste cigarettes.

[0002] In the field of cigarette making, waste in the form of waste cigarettes, loose tobacco material and loose wrapping paper pieces is generated. This waste material is subject to a separation treatment, which is performed to recycle the loose tobacco material. The tobacco material, which originates mainly from the waste cigarettes, can be reused in cigarette making. It is added to tobacco material for making the tobacco rod. The wrapping paper is not recycled; it is subject to a waste treatment.

[0003] The separation of the loose tobacco material from the wrapping paper pieces can be performed in various ways. One method of separating tobacco material and wrapping paper pieces applies chute sieves, for example. The waste material is poured onto the sieve which has a screening mesh width that is selected in that the tobacco material falls through the sieve while the bigger wrapping paper pieces remain on the sieve. As a result of this process, two separate output mass streams can be provided, a first one comprising the loose tobacco material and a second on comprising the wrapping paper pieces.

[0004] It is also known to treat waste cigarettes, which are output as waste by for example a cigarette maker, in a ripping machine having one or more cutting knives, for example circular blades. The waste cigarettes are cut lengthwise, i.e. along their longitudinal direction, in that the tobacco material comprised in these waste cigarettes can drop out. The loose tobacco and the loose wrapping paper pieces pass this ripping treatment substantially without any effect.

[0005] It is a goal of the ripping treatment to cut the waste cigarettes in a longitudinal direction along their entire length so as to achieve almost complete removal and separation of the tobacco material and the wrapping paper. For efficient lengthwise cutting of the waste cigarettes, it is however necessary to align the waste cigarettes in one or more parallel paths. These are fed to the cutting apparatus. In an attempt to avoid unnecessary impact on the tobacco material, the cutting knife penetrates the waste cigarettes very little. Hence, for efficient cutting, it is necessary to have an exact alignment of the waste cigarettes in longitudinal direction.

[0006] This alignment can be performed by for example a conveyor belt. The transport of waste cigarettes in longitudinal direction is performed in a plurality of parallel paths on the conveyor belt, which is for example known from WO 2012/144915 A1. The disclosed conveyor device comprises a multi belt conveyor, wherein the endless belt of the conveyor extends between an input roller and an output roller. The belt comprises a plurality of separate joining belts. The input roller has a circumferential surface having a shape forcing the joining belts to oscillate up and down during rotation. This movement supports the alignment of the waste cigarettes under the force of gravity while these are transported on the conveyor belt. However, in the situation when all grooves of the conveyor belt are completely filled up with waste cigarettes, it cannot be avoided that waste cigarettes not being aligned are also transported and delivered to the subsequent units. Misaligned waste cigarettes inevitably deteriorate the efficiency of the recycling process and the quality of the recycled material.

[0007] It is therefore an object of the invention to provide an apparatus for alignment of waste cigarettes and a method of aligning waste cigarettes allowing better and efficient alignment of waste cigarettes.

[0008] The object is solved by an apparatus according to claim 1 and by a method according to claim 10. Advantageous embodiments are subject of the dependent claims.

[0009] The object is solved by an apparatus for alignment of waste cigarettes, wherein these waste cigarettes are cigarettes with or without filter, and wherein the apparatus has an inlet for the waste cigarettes at an upper side of the apparatus and an outlet for aligned waste cigarettes at a lower side of the apparatus. The apparatus comprises a plurality of cylindrical rolls, each roll having an axis of rotation being aligned substantially parallel to each other. In other words, the axes of rotation of all the rolls of the apparatus are aligned parallel to each other.

[0010] The plurality of cylindrical rolls is in particular arranged in the apparatus in that a mass stream of waste cigarettes, which is fed into the apparatus via the inlet, is directly directed on the plurality of cylindrical rolls. The apparatus further comprises a drive unit being configured for rotating the rolls about their axis of rotation. There is a gap between neighbouring rolls, wherein this gap has a width which allows the aligned waste cigarettes to be conveyed through the gap.

[0011] The rotating rolls perform a fast and efficient alignment of the waste cigarettes. In addition to this, the apparatus is very compact. In comparison to the prior art, which is, for example, known from WO 2012/144915 A1, the transport in longitudinal direction of the waste cigarettes and the alignment of the waste cigarettes is separated. It is therefore not necessary to provide a very long conveyor belt for safeguarding accurate alignment of almost all waste cigarettes which are fed into the apparatus. Furthermore, the apparatus handles the waste cigarettes particularly careful. Hence, buckling, bending or breaking of the waste cigarettes can advantageously be avoided. The apparatus is further capable of delivering a continuous stream of aligned waste cigarettes and offers a high throughput capability.

[0012] Advantageously, the drive unit can be configured in that it drives at least two rolls being arranged next to each other in opposite directions of rotation. The opposite rotation of neighbouring rolls supports the rotation of initially misaligned cigarettes. For example, those cigarettes having a longitudinal direction, which is aligned perpendicular or nearly perpendicular to the axis of rota-

tion of the rolls, are turned about their own axis very fast.

[0013] According to another advantageous aspect of the invention, the rolls are arranged in a first plane and in a second plane, wherein the first and the second plane are distanced and arranged substantially parallel to each other. In particular, at least two rolls being arranged next to each other are arranged in different planes. This arrangement of the rolls further enhances the efficient alignment of the waste cigarettes.

[0014] According to another advantageous embodiment of the invention, at least one pair of rolls being arranged next to each other is arranged in a common plane. The drive unit is configured to drive the rolls of this pair in opposite directions of rotation. Furthermore, the apparatus comprises more than one pair of rolls, wherein the pairs of rolls are arranged in a common plan, for example an upper first plane. The pairs of rolls are in particular separated by a single roll, which is arranged in a different plane, for example a lower second plane. In other words, in an advantageous arrangement of the rolls, there are pairwise oppositely rotated rolls in a first and upper plane being separated by a single roll in a lower and second plane. This configuration turned out to be very efficient for careful and fast rotation of the waste cigarettes.

[0015] In still another advantageous embodiment of the invention, the rolls have a helically structured outer surface. In particular the outer surface has the structure of an external thread. The outer surface is the cylinder jacket of the cylindrical rolls.

[0016] The helical structure supports the alignment of the waste cigarettes. This in particular applies to a situation in which two rolls being arranged next to each other are driven in opposite directions of rotation and these neighbouring rolls have a helical structure of the same handedness. In other words, the helical structure of these two rolls is twisted in the same direction. When the helical structure is twisted in the same direction, i.e. has the same handedness, and at the same time the two neighbouring rolls are driven in opposite directions of rotation, the waste cigarette which is treated by this pair of rolls, turns with one end on one roll in a first direction and with the opposite end on the other roll in opposite direction. Depending on the direction of the handedness and the direction of rotation, this results in a clockwise or counterclockwise rotary motion of the waste cigarettes. The cigarette rotates about an axis which is substantially perpendicular to its own longitudinal axis. This is the fastest and most efficient mode of alignment.

[0017] In still another advantageous embodiment of the invention, a duct is arranged above the plurality of parallel rolls. The duct has substantially vertical sidewalls, wherein at least one sidewall comprises a recess or opening receiving one of the rolls. An axis of rotation is aligned substantially parallel to a longitudinal extension of this recess or opening. The axis of this roll is furthermore aligned substantially parallel to a plane in which the sidewall projects. The roll is received in this recess or opening in that an outer surface of the roll, i.e. the cylindrical jacket, projects beyond a plane which is defined by an inner surface of the sidewall. The roll projects beyond this plane by less than its radius. The drive unit can be configured in that said roll has a direction of rotation moving the outer surface of the roll projecting beyond the sidewall in a downward direction. Cigarettes, which can be get stuck at the sidewalls of the duct are forced downwards by this movement and at the same time the cigarettes are aligned. Advantageously, blocking of the apparatus can be avoided.

[0018] In still another advantageous embodiment of the invention, the apparatus comprises a conveyor belt being arranged in that waste cigarettes exiting the outlet are transported away in a conveying direction. The conveyor belt has a plurality of parallel channels being aligned in the conveying direction for receiving the aligned waste cigarettes. Furthermore, the apparatus comprises a device for applying a force on the waste cigarettes urging them into the channels or grooves of the conveyor belt. This can be performed, for example, by a flap, which is hinged perpendicular to the conveying direction. The edge of this flap urges the waste cigarettes into the channels of the conveyor belt. The weight of this flap can be adjusted in that a desired force is applied.

[0019] According to further aspects of the invention, which pertain to all embodiments of the invention, the number of rolls is uneven. In particular, seven rolls are applied. In another advantageous embodiment, four rolls, which means two pairs, are arranged in a first plane, while the remaining three rolls are arranged in a lower second plane. The first and the second plane are furthermore spaced from each other by a certain distance, which is in particular less than a diameter of the rolls. Furthermore, all rolls of the apparatus have the same diameter or radius.

[0020] The object is further solved by a method of aligning waste cigarettes with or without filter, the method comprising the steps of: feeding a mass stream comprising waste cigarettes to an inlet of an apparatus according to one or more of the above referred embodiments, operating the apparatus in that the drive unit drives the rolls about their axis of rotation, aligning the waste cigarettes by interaction between a surface of the rolls and the waste cigarettes, conveying the aligned waste cigarettes through the gap between the neighbouring rolls and delivering aligned waste cigarettes via the outlet.

[0021] In particular, the interaction between the rolls and the waste cigarettes takes place via a cylindrical jacket of the rolls. The method is particularly efficient as well as cost and time saving.

[0022] According to an advantageous embodiment of the invention, at least two rolls being arranged next to each other are driven in opposite directions of rotation.

[0023] Furthermore, in particular, the rolls are arranged in a first plane and in a second plane, the first and the second plane being arranged substantially parallel to each other.

[0024] At least one pair of rolls being arranged next to

each other is arranged in a common plane and the rolls of the pair are driven in opposite directions of rotation. This allows a very efficient and fast alignment of the waste cigarettes on the rolls.

[0025] According to another advantageous embodiment of the invention, the rolls have a helically structured outer surface, in particular an external thread. Two rolls being arranged next to each other, wherein the helical structure of the rolls has the same handedness, are driven in opposite directions, in that the waste cigarettes perform a helical movement during alignment and transition of the gap between the rolls. This helical movement, which means that the waste cigarettes turn about their own axis, is the fastest way for alignment. This is why this method is particularly efficient.

[0026] According to another advantageous embodiment of the invention, the apparatus comprises a duct being arranged above the plurality of parallel rolls, the duct having substantially vertical sidewalls. At least one sidewall comprises a recess or opening receiving one of the rolls in that an outer surface, which means the cylindrical jacket of the roll, projects beyond a plane defined by an inner surface of the sidewall by less than the radius of the roll. The roll is rotated in a direction of rotation moving the outer surface of the roll projecting beyond the sidewall in a downward direction. This prevents waste cigarettes from getting stuck at this part of the duct.

[0027] The method is also further enhanced in that the apparatus further comprises a conveyor belt being arranged below the outlet in that waste cigarettes exiting the outlet are transported away in a conveying direction. The conveyor belt has a plurality of parallel channels being aligned in the conveying direction. A force is applied on the waste cigarettes urging them into the channels of the conveyor belt. This safeguards an accurate and almost complete alignment of the cigarettes.

[0028] The invention also relates to an apparatus for separation of waste material in the tobacco industry, in particular waste of a cigarette maker, the apparatus having an inlet for a mass stream of waste material, the waste material comprising waste cigarettes with and without filter, the apparatus comprising a ripping unit for the waste cigarettes, the ripping unit comprising an apparatus for alignment of waste cigarettes according to one of the named embodiments, the apparatus having an outlet for transfer of the aligned waste cigarettes to a downstream conveyor belt, a cutting and knock-out unit for opening the waste cigarettes and for knocking out of the loose tobacco material and a separation unit, which is configured for separating the loose tobacco material and pieces of wrapping paper while proving a first output mass stream of loose tobacco material and a second output mass stream comprising pieces of wrapping paper, wherein the separation unit comprises a rotative screen (for example a sieving drum) for separating the loose tobacco material and the pieces of wrapping paper.

[0029] Further characteristics of the invention will become apparent from the description of the embodiments according to the invention together with the claims and the included drawings. Embodiments according to the invention can fulfill individual characteristics or a combination of several characteristics.

[0030] The invention is described below, without restricting the general intent of the invention, based on exemplary embodiments, wherein reference is made expressly to the drawings with regard to the disclosure of all details according to the invention that are not explained in greater detail in the text. The drawings show in:

FIG. 1 a simplified schematic illustration of a recycling process of a mass stream of waste exiting a cigarette maker, wherein a first and a second mass stream of waste material and recycled to-bacco material, respectively, is generated,

FIG. 2a a simplified schematic illustration of a device for reprocessing this waste stream,

FIG. 2b a simplified schematic illustration of another device for reprocessing this waste stream,

FIG. 3 a detail of an apparatus for alignment of waste cigarettes in a simplified perspective view,

FIG. 4 the apparatus for alignment of waste cigarettes in a simplified perspective view to an upper side,

FIG. 5 a simplified top view to the apparatus for alignment of waste cigarettes and

FIG. 6 a detailed simplified perspective view to the apparatus for alignment of waste cigarettes from the lower side.

[0031] In the drawings, the same or similar elements or respectively corresponding parts are provided with the same reference numbers in order to prevent the item from needing to be reintroduced.

[0032] FIG. 1 illustrates a recycling process of a mass stream 10 of waste material exiting for example a cigarette maker. This mass stream 10 is processed and as a result, a first output mass stream 16, which mainly comprises loose tobacco material 4, and a second output mass stream 18, mainly comprising loose wrapping paper pieces 6, can be provided. This process is performed by an apparatus 20 for the separation of waste material 10 that is schematically illustrated in FIG. 1.

[0033] The mass stream 10 of waste material comprises waste cigarettes 2, loose tobacco material 4 and pieces of wrapping paper 6. The mass stream 10 results for example from cigarette making, however, other sources are also possible. The mass stream 10 of waste material is separated in the apparatus 20 for separation, which comprises a first separation unit 30, a ripping unit 40 and

a second separation unit 50.

[0034] The mass stream 10 of waste material is fed into an inlet 22 of the first separation unit 30. The inlet 22 is a part of a chute 32 that is interrupted by a cross separator 33. The cross separator 33 includes an airstream source 36, for example a fan or blower, generating a cross airstream 34 in an airstream supply line 37. The stream is guided across the chute 32. The cross airstream 34 takes the loose waste material, which means almost the entire loose tobacco material 4 and almost all pieces of wrapping paper 6 with it. The waste cigarettes 2 fall through the chute 32 downwards to the outlet 38 of the first separation unit 30. The waste cigarettes 2 enter an apparatus 42 for alignment of waste cigarettes 2. This will be explained in more detail further below. The mass stream of loose tobacco material 4 and wrapping paper 6 is guided through a bypass 39 directly to the second separation unit 50, which will also be explained in detail further below.

[0035] The ripping unit 40 comprises the apparatus 42 for alignment of waste cigarettes 2, a conveyor belt 44, which can be also a part of the apparatus 42 for alignment, a cutting knife 46, which is for example configured as a circular blade, and a knock-out unit 48. In the apparatus 42 for alignment of waste cigarettes 2, which is configured according to aspects of the invention, the randomly oriented waste cigarettes 2 are aligned in a common direction for subsequent longitudinal transport on the conveyor belt 44. The waste cigarettes 2 are cut lengthwise by the cutting knife 46, which penetrates the wrapping paper of the waste cigarettes 2 only very little to avoid damage of the tobacco material. The waste cigarettes 2 are opened along their entire length and in the subsequent knock-out unit 48 the loose tobacco material 4 is beaten out of the wrapping paper. This leads to a mass stream comprising no waste cigarettes 2, but only loose tobacco material 4 and loose wrapping paper pieces 6.

[0036] In the second separation unit 50, there is, for example, a rotative screen 52 (sieving drum) for separating the loose tobacco material 4 and the pieces of wrapping paper 6. The mesh size of the rotative screen 52 is configured in that the loose tobacco material 4 passes the rotative screen 52, while the pieces of wrapping paper 6 remain inside the drum. The pieces of wrapping paper 6 travel to the end face of the sieving drum. An axis of rotation of the rotative screen 52 is in particular oriented horizontally. According to further embodiments, the axis of rotation is inclining (in a direction of transport through the sieving drum) or declining. Furthermore, according to still another embodiment, the orientation of the axis is variably adjustable. In another advantageous embodiment of the invention, in the second separation unit 50, there is a vibrating screen (vibrating sieve) for separating the loose tobacco material 4 and the pieces of wrapping paper 6. The mesh size of the vibrating screen is configured in that the loose tobacco material 4 passes the vibrating screen, while the pieces of wrapping paper 6 remain on top of it. Advantageously, the rotative screen 52 avoids vibrations. The vibrating screen advantageously avoids rotations.

[0037] As a result of this separation process, the first output mass stream 16 comprising the loose tobacco material 4 and the second output mass stream18 comprising mainly the wrapping paper pieces 6 exits the apparatus 20.

[0038] In FIG. 2a, there is a simplified perspective view on an apparatus 20 for separation of waste material. At the top, there is the inlet 22 for the mass stream 10 of waste material. This inlet 22 leads to the chute 32, which is interrupted by the cross separator 33. The figure shows a cross airstream inlet 35 through which the cross airstream 34 enters the chute 32. The cross airstream 34 passes the chute 32 and enters the bypass 39, wherein the loose tobacco material 4 and the wrapping paper pieces 6 are separated from the waste cigarettes 2. The bypass 39 guides this mass stream to the second separation unit 50 being arranged in the lower part of the apparatus 20.

[0039] The chute 32 guides downwards towards the conveyor belt 44 having a plurality of parallel channels for accommodating the waste cigarettes 2. On their way from the chute 32 to the conveyor belt 44, the waste cigarettes 2 are aligned in longitudinal direction.

[0040] The apparatus 42 for alignment of the waste cigarettes 2 is not visible in FIG. 2a. Also the cutting knife 46 and the knock-out unit 48 are not visible. They are arranged on the back side of the cutting and knock-out unit 45, which comprises these three components.

[0041] In FIG. 2b, there is a simplified perspective view on another apparatus 20 for separation of waste material, according to a further embodiment of the invention. At the top, there is the inlet 22 for the mass stream 10 of waste material. This inlet 22 leads to the chute 32, which is interrupted by the cross separator 33. The cross airstream 34 (see FIG. 1) passes the chute 32 and enters the bypass 39, wherein the loose tobacco material 4 and the wrapping paper pieces 6 are separated from the waste cigarettes 2. The bypass 39 guides this mass stream to the second separation unit 50 being arranged in the lower part of the apparatus 20.

[0042] The chute 32 guides downwards towards the conveyor belt 44, which is itself not visible in the figure. The conveyor belt is configured as it is illustrated in FIG. 2a. It features a plurality of parallel channels for accommodating the waste cigarettes 2. On their way from the chute 32 to the conveyor belt 44, the waste cigarettes 2 are aligned in longitudinal direction. The apparatus 42 for alignment of the waste cigarettes 2 is explained in more detail further below. The aligned waste cigarettes 2 are cut by a cutting knife 46 and the tobacco is knocked out of the opened waste cigarettes 2 in the knock-out unit 48. These two units are itself not visible. They are arranged in the cutting and knock-out unit 45.

[0043] At the beginning of the second separation unit 50 at the left-lower end thereof, the mass stream of loose

tobacco material 4 and loose pieces of wrapping paper 6 enter this unit. The second separation unit 50 comprises a rotative screen 52 (sieving drum) and a conveyor for separating the loose tobacco material 4 and the wrapping paper pieces 6. The loose tobacco material 4 passes the rotative screen 52 and as a result of this, the loose tobacco material 4 is transported on a lower transport plane 56 while the mass stream of pieces of wrapping paper 6 is transported in an upper transport plane 54. The first and second output mass streams 16, 18, which have been explained before, exit the apparatus 20 for separation of waste material at the upper end of the second separation unit 50. The apparatus 42 for alignment of the waste cigarettes 2, which can be included in the apparatus 20 shown in FIG. 2 will now be explained in more detail by making reference to FIGS. 3 to 6.

[0044] According to an embodiment of the invention, an apparatus 20 for separation of waste material in the tobacco industry, in particular waste of a cigarette maker is provided. The apparatus 20, which is shown for example in FIG. 2b, has an inlet 22 for the mass stream 10 of waste material. The waste material comprises waste cigarrettes 2 with and/or without filter. The apparatus 20 comprises a ripping unit 40 for the waste cigarettes 2, wherein the ripping unit 40 comprising an apparatus 42 for alignment of waste cigarettes 2 according to one of the described embodiments. The apparatus 42 has an outlet 84 for transfer of the aligned waste cigarettes 2 to the downstream conveyor belt 44. Furthermore, the ripping unit 40 comprises a cutting and knock-out unit 45 for opening the waste cigarettes 2 and for knocking out of the loose tobacco material 4. The separation unit 50 is configured for separating the loose tobacco material 4 and pieces of wrapping paper 6 while proving the first output mass stream 16 of loose tobacco material 4 and the second output mass stream 18 comprising pieces of wrapping paper 6. The separation unit 50 comprises the rotative screen 52 (for example a sieving drum) for separating the loose tobacco material 4 and the pieces of wrapping paper 6.

[0045] In FIG. 3, there is a simplified detailed perspective view on the apparatus 42 for alignment of waste cigarettes 2. FIG. 4 illustrates a simplified perspective view on the apparatus 20 from the upper side.

[0046] The apparatus 42 comprises an inlet 60, which is inserted in a top panel 62 at an upper side. Through the inlet 60, the waste cigarettes 2 are fed into the apparatus 42. The inlet 60 leads to a duct having substantially vertical sidewalls 64a, 64b as well as a front wall 66a and a rear wall 66b. The apparatus 42 further comprises a plurality of cylindrical rolls 68a-68g, each having an axis of rotation 70a-70g. All axes of rotation 70a-70g are arranged substantially parallel to each other. The apparatus 42 further comprises a drive unit 72, for example an electrical motor, which is configured to rotate the rolls 68a-68g about their axis of rotation 70a-70g.

[0047] FIG. 5 shows a simplified top view on the apparatus 42, wherein the top panel 62 is omitted for clarity reasons. By way of an example, the drive unit 72 drives the rolls 68a-68g via a belt drive which for example applies a toothed belt 74 meshing with gear wheels 76a-76g being mounted on one terminal end of each of the rolls 68a-68g. The toothed belt 74 is also guided by various guide rollers. In the simplified perspective view of FIG. 6 showing a detail of the apparatus 42 from a lower side, the gear wheels 76a-76g are visible.

[0048] Between neighbouring rolls 68a-68g there are gaps 78. The gaps 78 have a width which allows the aligned waste cigarettes 2 to be conveyed through the gap 78. The width of the gap 78 is measured in a direction perpendicular to the axis of rotation 70a-70g of the neighbouring rolls 68a-68g. The aligned waste cigarettes 2 are aligned almost parallel to the rolls and fall through the gap 78 in transverse direction to their longitudinal axis.

[0049] The apparatus 42 and its drive unit 72 are configured in that at least two rolls 78a-78g being arranged next to each other rotate in opposite direction. The direction of rotation of the rolls 68a-68g is indicated in FIG. 3 by bent arrows. In detail, the rolls 68a, 68b and 68e rotate clockwise while the rolls 68c, 68d, 68f and 68g rotate counterclockwise.

[0050] Furthermore, the rolls 68a-68g have an outer surface, i.e. a cylinder jacket, having a helical structure. The helically structured outer surface is in particular an external thread. Rolls 68a-68g having an opposite direction of rotation, for example the pair of rolls denoted 68b and 68c as well as the pair of rolls 68e and 68f, have a helically structured outer surface having the same handedness. In the embodiment, the helical structures of all rolls 68a-68g have the same handedness. In other words, the external thread is tilted in the same direction.

[0051] Due to the fact, the neighbouring rolls 68b, 68c and 68e, 68f rotate in opposite directions, a waste cigarette 2 which interacts with both of the outer surfaces of these pairs of rolls, performs a rotation about its own axis. The cigarette 2 is turned from, for example, an orientation being substantially perpendicular to the axis of rotation 70a-70g of the rolls 68a-68g to a position substantially parallel to the gaps 78 between the respective pair of rolls 68a-68g. Upon this rotation, the waste cigarette 2 performs a helical movement and finally enters the gap 78 between the rolls 68a-68g.

[0052] After the alignment, the waste cigarettes 2 exit the apparatus 42 through an outlet 82, which is for example the bottom side of the apparatus 42 shown in FIG. 6. At this bottom side, a conveyor belt 44 (see FIG. 2) is arranged. This conveyor belt 44 can be a part of the apparatus 42. It comprises a plurality of the longitudinal grooves for receiving the aligned waste cigarettes 2.

[0053] The rolls 68a-68g are arranged in a first plane and in a second plane, according to the depicted embodiment. For example, as shown in FIG. 3, the rolls 68a, 68d and 68g are arranged in a second and lower plane while the rolls 68b, 68c, 68e and 68f are arranged in a first and higher plane. The two planes are spaced by a certain distance. The respective axis of rotation 70a, 70d,

70g on the one hand and 70b, 70c, 70e and 70f on the other hand are arranged in the respective first and second plane. This offset arrangement of the rolls 68a-68g supports the efficient alignment of the waste cigarettes 2.

[0054] The substantially vertical sidewalls 64a, 64b of the duct, which is arranged above the plurality of rolls 68a-68g, each comprise an opening in which one of the rolls 68a-68g is arranged. According to the embodiment of FIG. 3, this applies to the roll 68a, which is arranged in the opening of the sidewall 64a and to the roll 68g, which is arranged in an opening of the opposite sidewall 64b. These two peripheral rolls 68a, 68g are arranged in the respective opening in that their outer surface projects beyond a plane, which is defined by an inner surface of the respective sidewall 64a, 64b. The outer surface of the roll 68a, 68g projects beyond the inner surface of the sidewall 64a, 64b by less than the radius R of the respective roll 68a, 68g. The direction of rotation of the roll 68a, 68g, which is indicated by an arrow, is such that the moving outer surface of the roll 68a, 68g projecting beyond the sidewall 64a, 64b moves in a downward direction D. This pushes waste cigarettes 2 at the side of the duct through the corresponding gap 78 between rolls 68a, 68b and 68f, 69g, respectively.

[0055] Furthermore, the apparatus 42 comprises a flap 80, which applies a force on the waste cigarettes 2 and urges them into the channels of the conveyor belt 44. The flap 80 is hinged on the rear wall 66b and can be tilted along a direction which is perpendicular to the axis of rotation 70a-70g of the rolls 68a-68g. A terminal edge 82 of the flap 80 applies the force on the waste cigarettes 2. The weight of the flap 80 can be selected such that the desired force is applied under the force of gravity.

[0056] In a further embodiment of the invention, a method of aligning the waste cigarettes 2 is provided. This method is also illustrated in FIG. 1. Reference is made to the corresponding explanations given above. In this method, a mass stream 10 comprising waste cigarettes 2 is fed to an inlet 60 of the apparatus 42 according to an embodiment of the invention. The apparatus 42 is operated in that the drive unit 72 drives the rolls 68a-68g about their respective axis of rotation 70a-70g. The waste cigarettes 2 are aligned by interaction between the surface of the rolls 68a-68g and the waste cigarettes 2. The aligned waste cigarettes 2 are conveyed through the gap 78 between neighbouring rolls 68a-68g. The waste cigarettes 2 are delivered via the outlet 84, which is, for example, the bottom side of the apparatus 42 shown in FIG. 6 to the conveyor belt 44.

[0057] All named characteristics, including those taken from the drawings alone, and individual characteristics, which are disclosed in combination with other characteristics, are considered alone and in combination as important to the invention. Embodiments according to the invention can be fulfilled through individual characteristics or a combination of several characteristics. Features that are combined with the wording "in particular" or "especially" are to be treated as preferred embodiments.

List of reference numbers

[0058]

2	waste cigarettes
4	loose tobacco material
6	pieces of wrapping paper
10	mass stream of waste material
16	first output mass stream
18	second output mass stream
20	apparatus for separation
22	inlet
30	first separation unit
32	chute
33	cross separator
34	cross airstream
35	cross airstream inlet
36	airstream source
37	airstream supply line
38	outlet
39	bypass
40	ripping unit
42	apparatus for alignment
44	conveyor belt
45	cutting and knock-out unit
46	cutting knife
48	knock-out unit
50	second separation unit
52	rotative screen
54	upper transport plane
56	lower transport plane
60	inlet
62	top panel
64a, 64b	sidewalls
66a	front wall
66b	rear wall
68a-68g	rolls
70a-70g	axis of rotation
72	drive unit
74	toothed belt
76a-76g	fear wheels
78	gap
80	flap
82	terminal edge
84	outlet

R radius
D download direction

Claims

1. An apparatus (42) for alignment of waste cigarettes (2) with or without filter having an inlet (60) for the waste cigarettes (2) at an upper side of the apparatus (42) and an outlet (84) for aligned waste cigarettes (2) at a lower side of the apparatus (42), comprising a plurality cylindrical rolls (68a-68g), each having an

axis (70a-70g) of rotation being aligned substantially parallel to each other, further comprising a drive unit (72) being configured for rotating the rolls (68a-68g) about their axis (70a-70g) of rotation, wherein there is a gap (78) between neighbouring rolls (68a-68g), the gap (78) having a width which allows the waste cigarettes (2) to be conveyed through the gap (78).

2. The apparatus (42) according to claim 1, wherein the drive unit (72) is configured in that it drives at least two rolls (68a-68g) being arranged next to each other in opposite directions of rotation.

3. The apparatus (42) according to any of the preceding claims, wherein the rolls (68a-68g) are arranged in a first plane and in a second plane, wherein the first and the second plane are distanced and arranged substantially parallel to each other.

4. The apparatus (42) according to claim 3, wherein at least two rolls (68a-68g) being arranged next to each other are arranged in different planes.

5. The apparatus (42) according to claim 3 or 4, wherein at least one pair of rolls (68a-68g) being arranged next to each other is arranged in a common plane, wherein the drive unit (72) is configured to drive the rolls (68a-68g) of the pair in opposite directions of rotation.

6. The apparatus (42) according to any of the preceding claims, wherein the rolls (68a-68g) have a helically structured outer surface, in particular an external thread.

7. The apparatus (42) according to claim 2 and 6, wherein the helical structure of the two rolls (68a-68g) being arranged next to each other and being driven in opposite directions of rotation has the same handedness.

8. The apparatus (42) according to anyone of the preceding claims, wherein a duct is arranged above the plurality of parallel rolls (68a-68g), the duct having substantially vertical sidewalls (64a, 64b), wherein at least one sidewall (64a, 64b) comprises a recess or opening receiving one of the rolls (68a-68g) in that an outer surface of the roll (68a-68g) projects beyond a plane defined by an inner surface of the sidewall (64a, 64b) by less than the radius (R) of the roll (68a-68g), wherein the drive unit (72) is configured in that said roll (68a-68g) has a direction of rotation moving the outer surface of the roll (68a-68g) projecting beyond the sidewall (64a, 64b) in a downward direction (D).

9. The apparatus (42) according to anyone of the preceding claims, further comprising a conveyor belt (44) being arranged in that waste cigarettes (2) exiting the outlet (82) are transported away in a conveying direction, the conveyor belt (44) having a plurality of parallel channels being aligned in the conveying direction, further comprising a device (80) for applying a force on the waste cigarettes (2) urging them into the channels of the conveyor belt (44).

10. A method of aligning waste cigarettes (2) with or without filter, comprising the steps of: feeding a mass stream (10) comprising waste cigarettes (2) to an inlet (60) of an apparatus (42) according to any of claims 1 to 9, operating the apparatus (42) in that the drive unit (72) drives the rolls (68a-68g) about their axis (70a-70g) of rotation, aligning the waste cigarettes (2) by interaction between a surface of the rolls (68a-68g) and the waste cigarettes (2), conveying the aligned waste cigarettes (2) through the gap (78) between neighbouring rolls (68a-68g), delivering aligned waste cigarettes (2) via the outlet (84).

11. The method according to claim 10, wherein at least two rolls (68a-68g) being arranged next to each other are driven in opposite directions of rotation.

12. The method according to claim 10 or 11, wherein the rolls (68a-68g) are arranged in a first plane and in a second plane, wherein the first and the second plane are distanced and arranged substantially parallel to each other, and wherein at least one pair of rolls (68a-68g) being arranged next to each other is arranged in a common plane and the rolls (68a-68g) of the pair are driven in opposite directions of rotation.

13. The method according to any of the claims 10 to 12, wherein the rolls (68a-68g) have a helically structured outer surface, in particular an external thread, and two rolls (68a-68g) being arranged next to each other, the helical structure of the rolls (68a-68g) having the same handedness, are driven in opposite directions, in that the waste cigarettes (2) perform a helical movement during alignment and transition of the gap (78) between the rolls (68a-68g).

14. The method according to any of the claims 10 to 13, wherein the apparatus (42) comprises a duct being arranged above the plurality of parallel rolls (68a-68g), the duct having substantially vertical sidewalls (64a, 64b), wherein at least one sidewall (64a, 64b) comprises a recess or opening receiving one of the rolls (68a-68g) in that an outer surface of the roll (68a-68g) projects beyond a plane defined by an inner surface of the sidewall (64a, 64b) by less than the radius (R) of the roll (68a-68g), and wherein the roll (68a-68g) is rotated in a direction of rotation moving the outer surface of the roll (68a-68g) projecting beyond the sidewall (64a, 64b) in a downward direc-

tion (D).

15. The method according to anyone of claims 1 to 14, the apparatus (42) further comprises a conveyor belt (44) being arranged below the outlet (84) in that waste cigarettes (2) exiting the outlet (84) are transported away in a conveying direction, the conveyor belt (44) having a plurality of parallel channels being aligned in the conveying direction, wherein a force is applied on the waste cigarettes (2) urging them into the channels of the conveyor belt (4).

Fig. 1

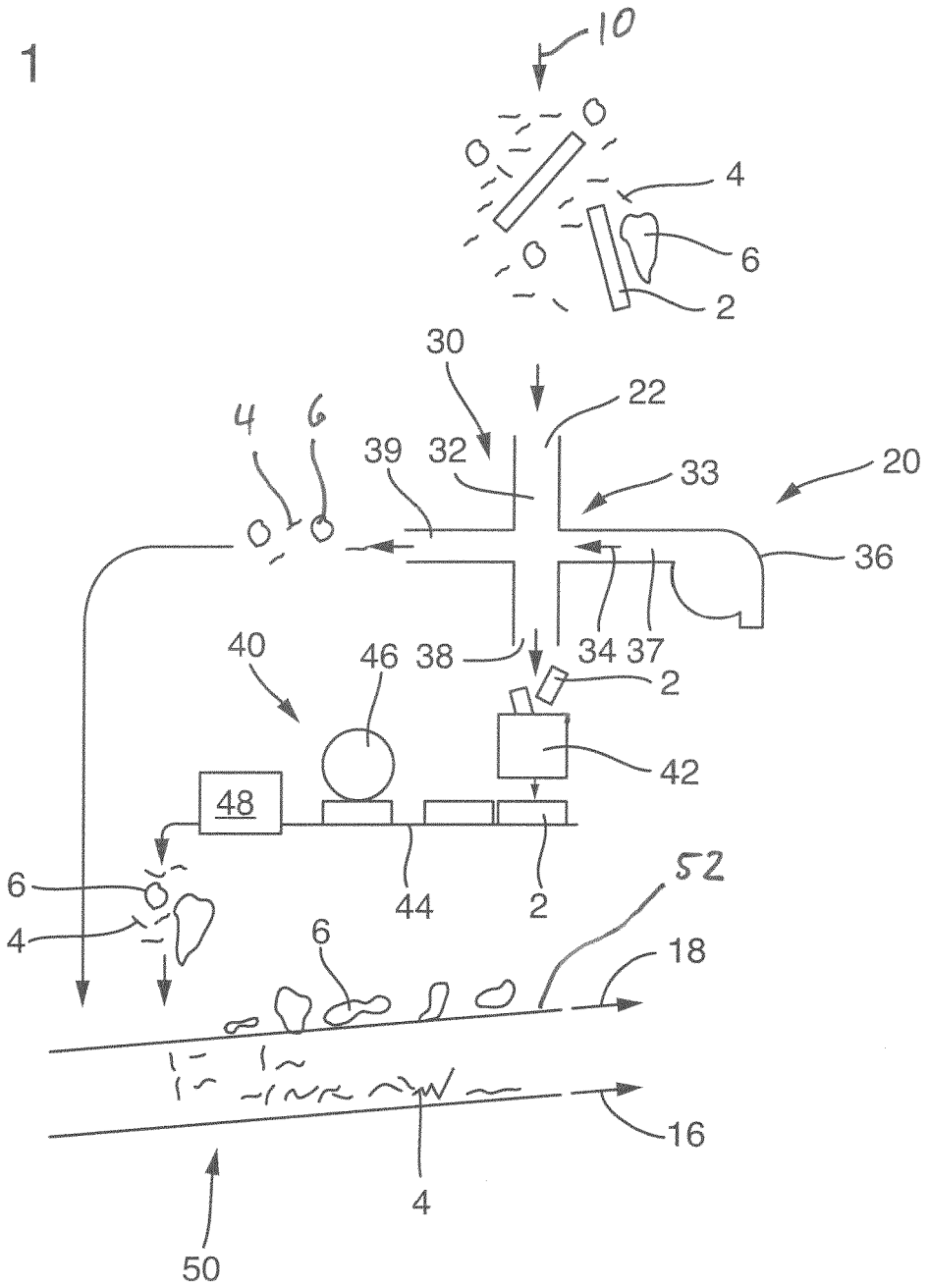
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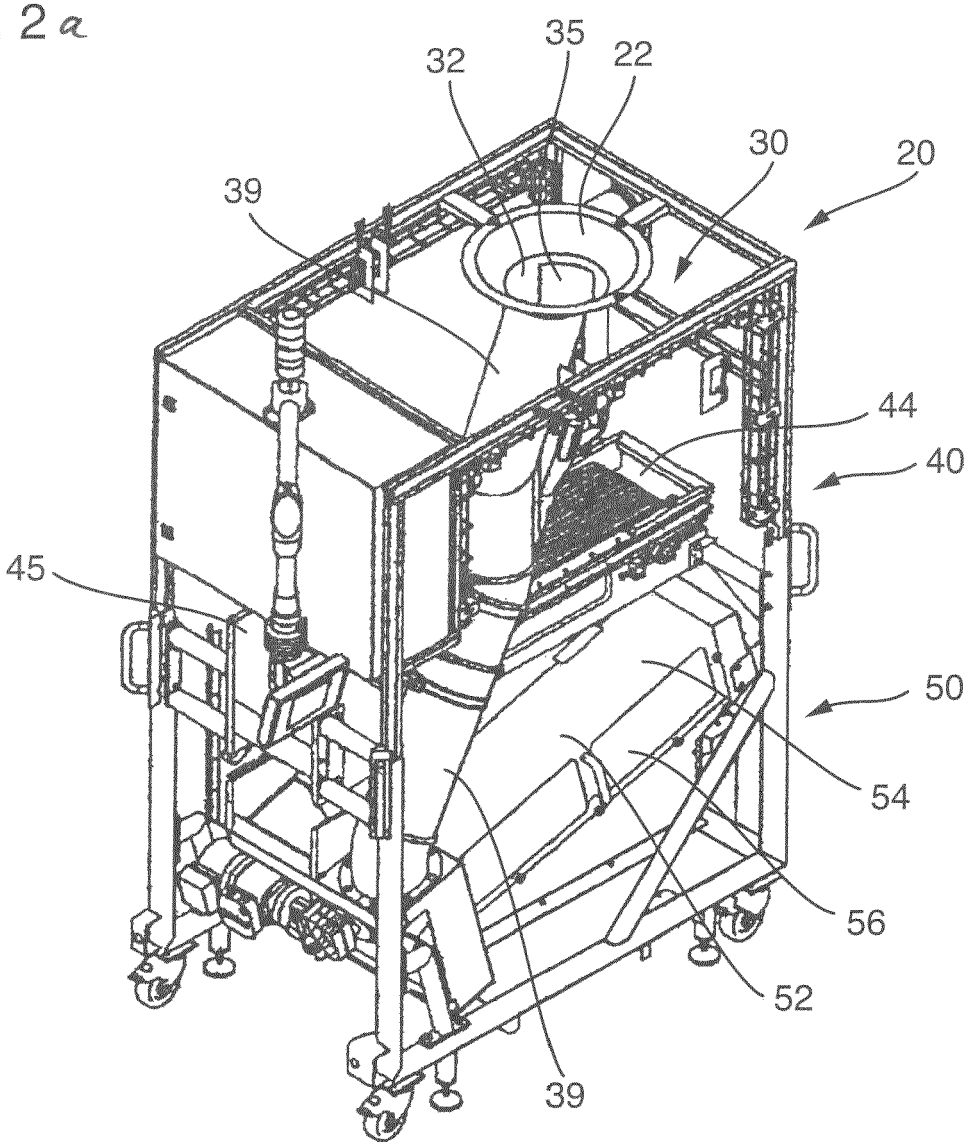
Fig. 2a



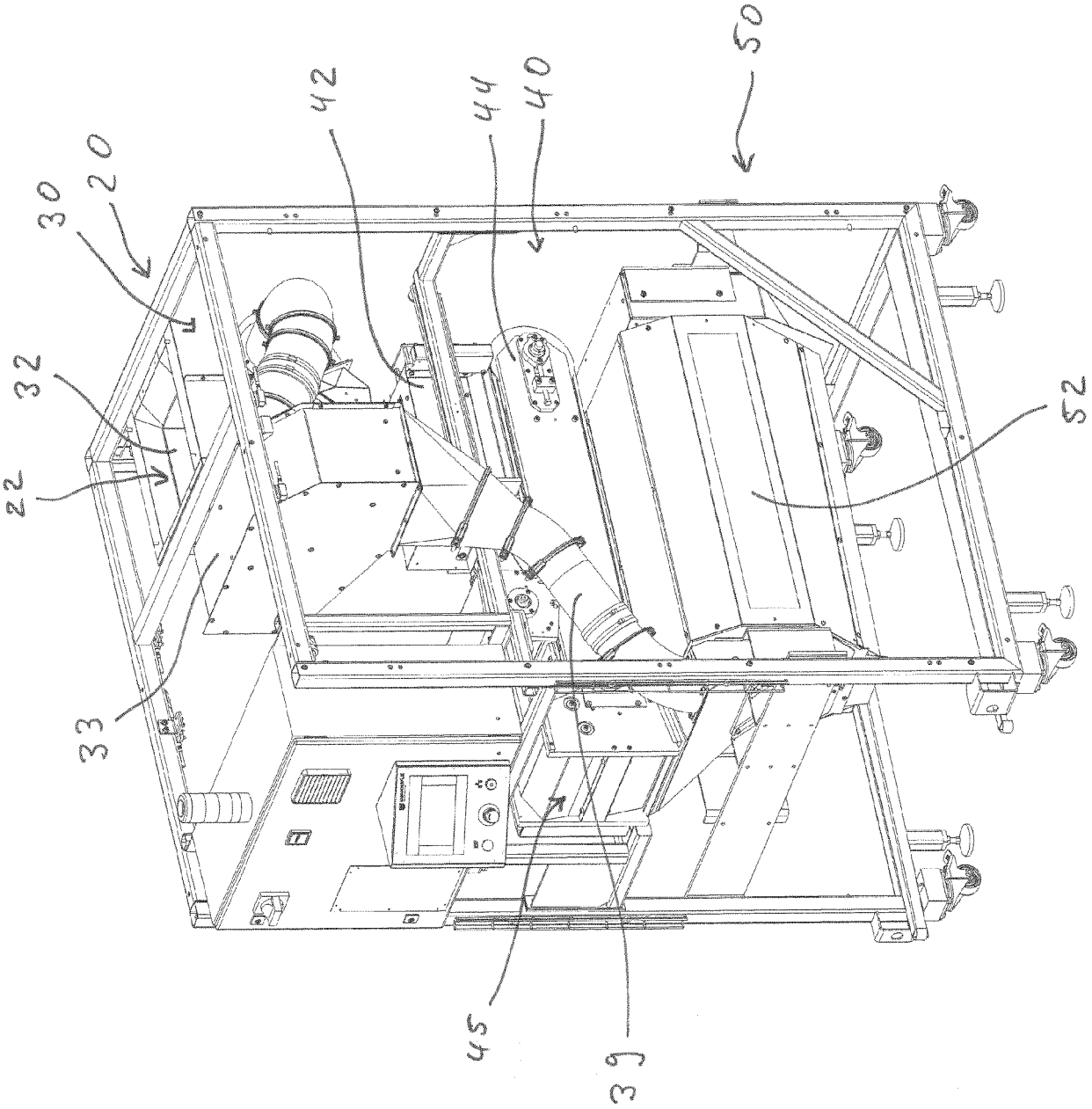
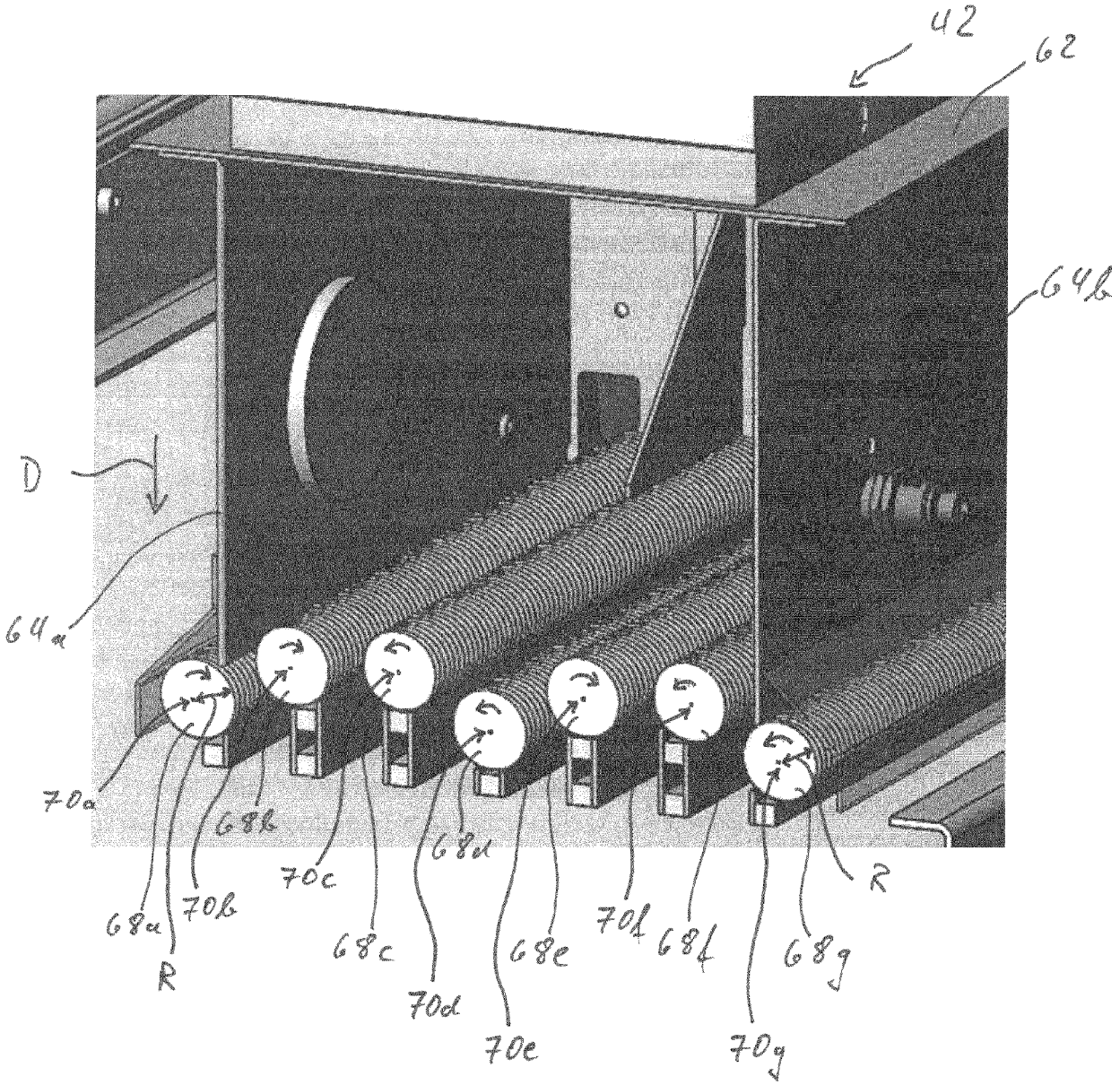


Fig. 2b

Fig. 3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68g
R

Fig. 4

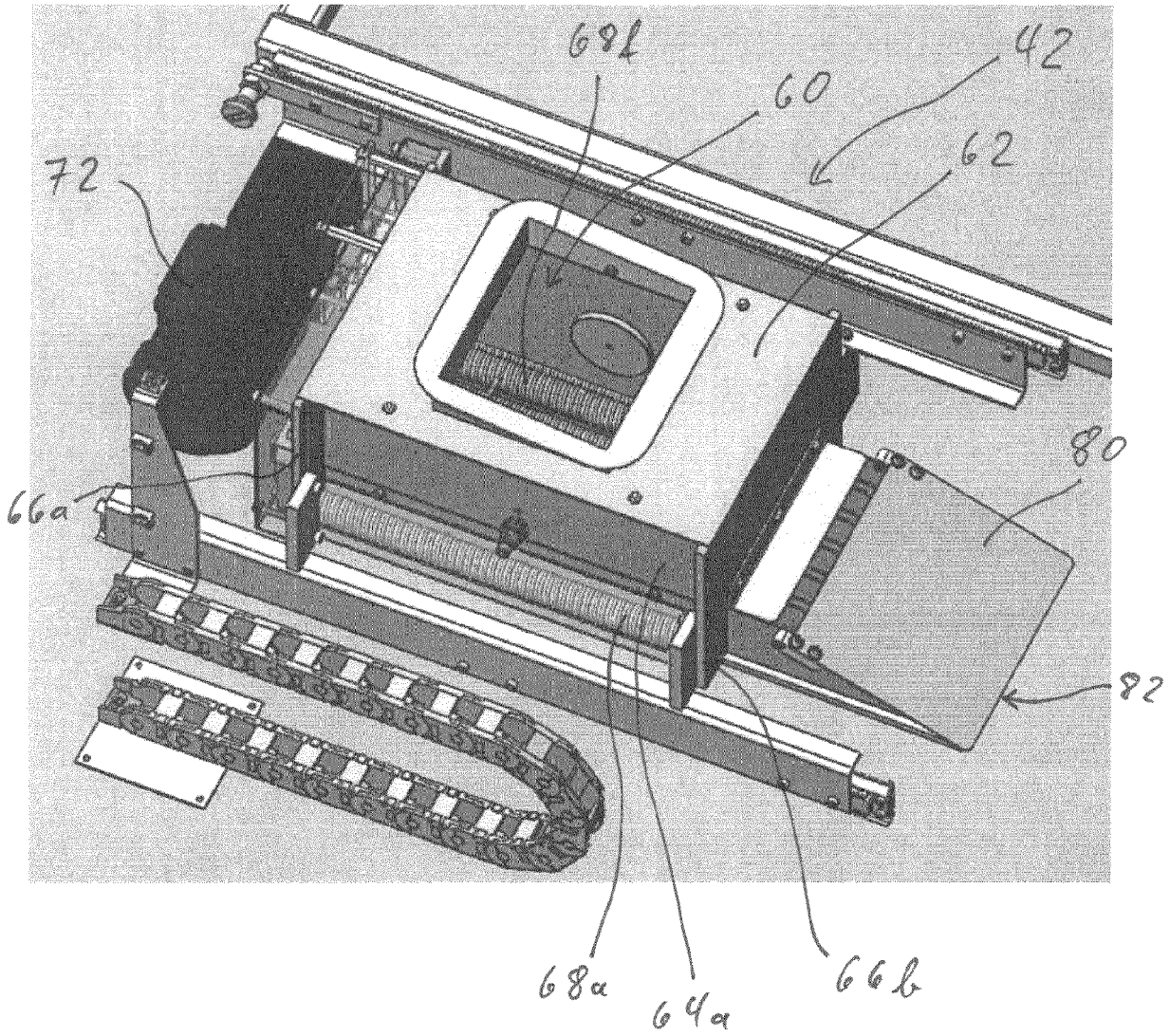


Fig. 5

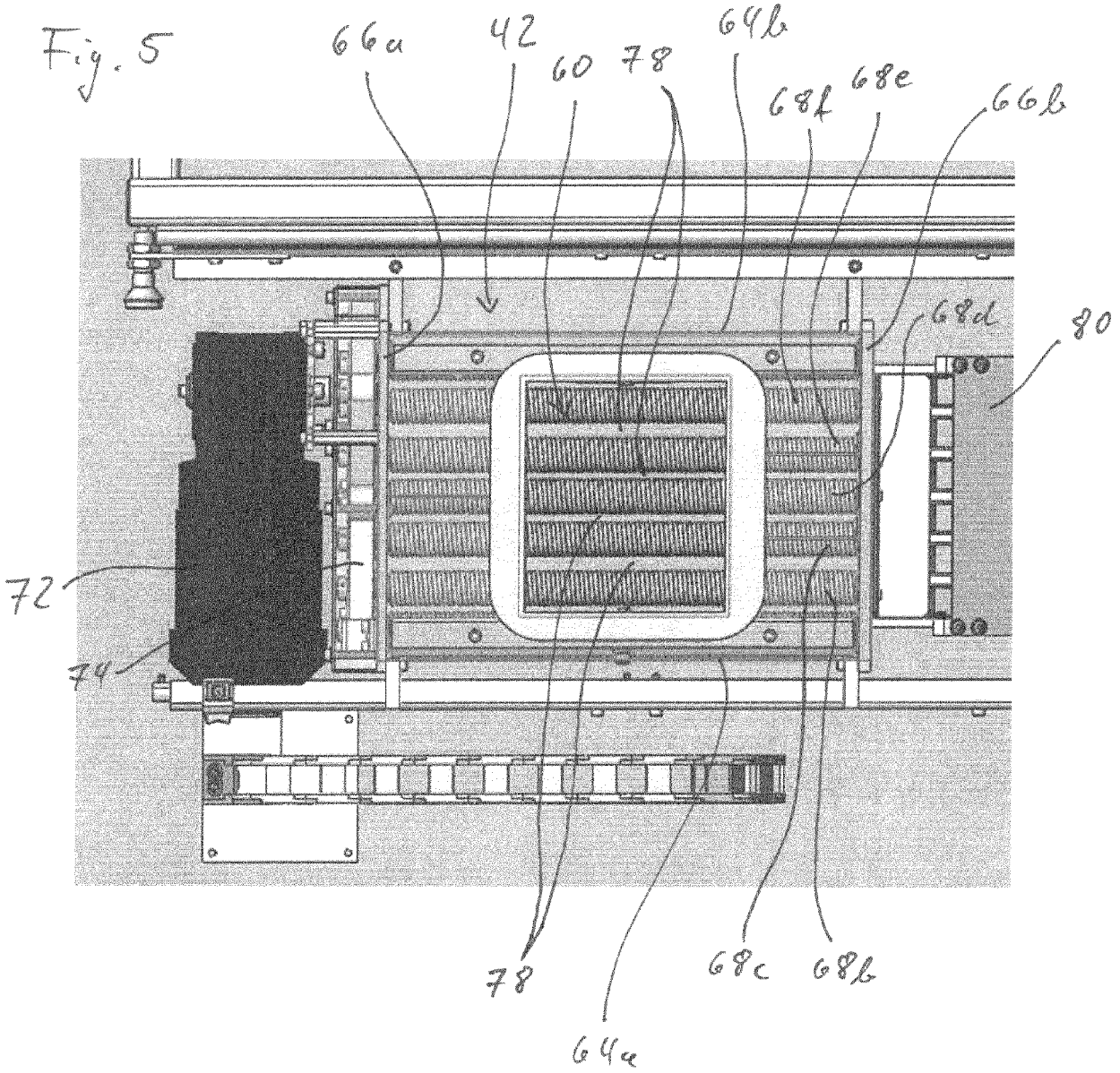
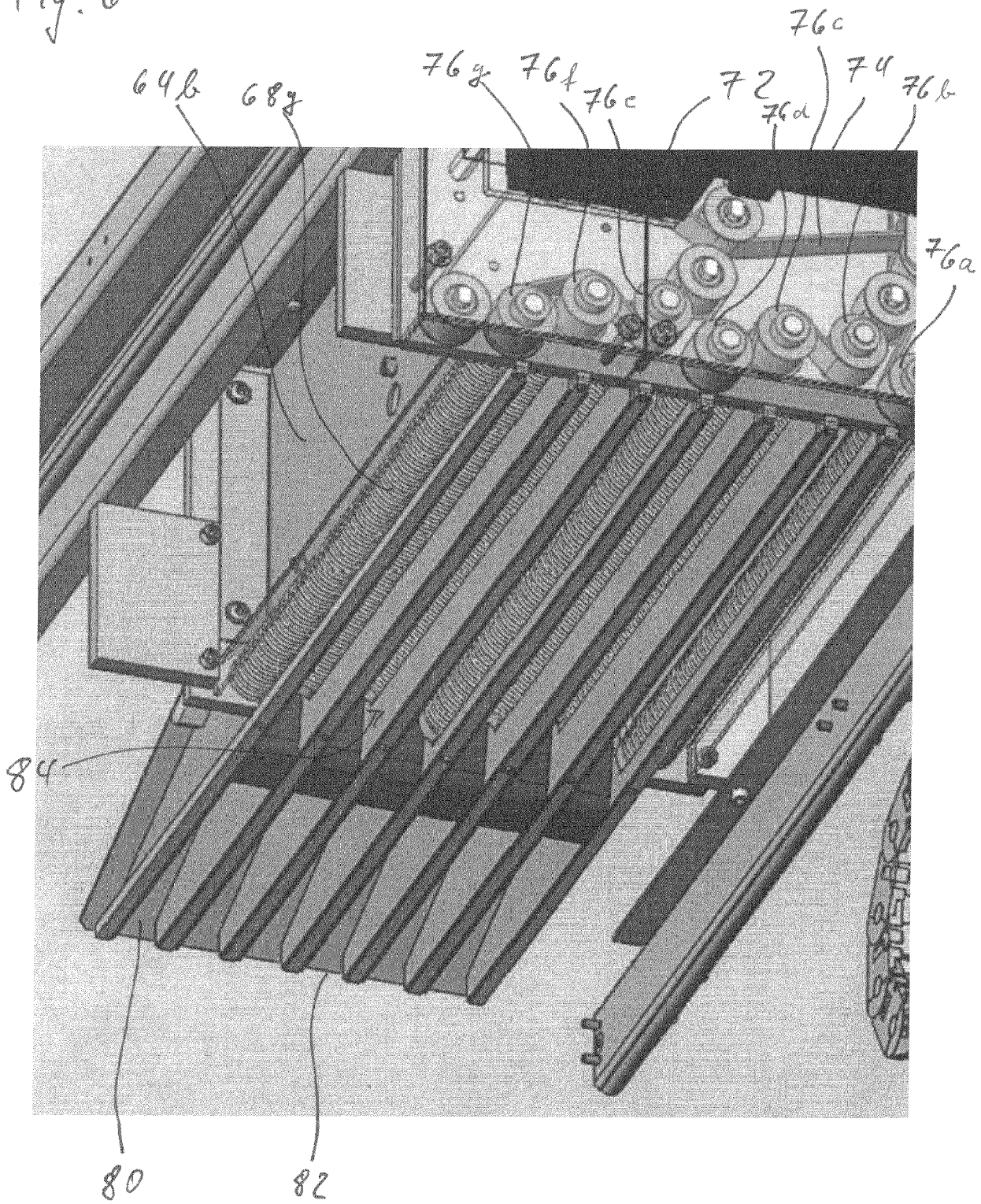


Fig. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 17 18 1673

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X	DE 183 694 C (FEILOTTER, OSCAR) 28 August 1906 (1906-08-28) * the whole document *	1-4,10, 11	INV. A24C5/36
A,D	WO 2012/144915 A1 (INT TOBACCO MACHINERY POLAND [PL]; SIEREDZINSKI MAREK [PL]; FIGARSKI J) 26 October 2012 (2012-10-26) * claim 1; figures 1,7,8 *	1-15	
A	US 3 366 125 A (JACKSON JOHN L) 30 January 1968 (1968-01-30) * column 2, lines 36-42; figures 1-3 *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC) A24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 December 2017	Schwarzer, Bernd

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08-12-2017

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