Title: A CARDING MACHINE

Abstract: The present invention relates to a carding machine (1) designed preferably to operate in a plant for producing padding (I), which has a variable configuration thanks to which it is possible to vary very quickly the intensity of the treatment or processing which the carding machine (1) performs on the fibres.
DESCRIPTION

A CARDING MACHINE

Technical field
The present invention relates to a carding machine designed preferably to operate in a plant for producing padding or wadding, which has a variable configuration thanks to which it is possible to vary very quickly the intensity of the treatment or processing which the carding machine performs on the fibres.

Background art
In the field of producing padding, in particular for mattresses, the carding machine is used in particular for combing, separating and parallelising the discontinuous fibres which will then be used to create the padding. These operations are performed by the passage of the fibres between rotary elements which are provided with suitable processing means such as, for example, teeth, needles or plates, which are designed to exert actions for retaining and moving the fibres, to obtain at the outfeed a layer of material which can have different configurations regarding the orientation and the separation of the fibres. The known carding machines comprise a first rotary element called in jargon a licker-in, a second rotary element called in jargon a drum and a plurality of processing cylinders. These elements work the fibres by making them pass along a working path which comprises stretches or sectors tangential at least partly to the elements themselves, constituting a processing area interposed between these elements.
The working of the fibres may be very intense at these working areas.

To vary the intensity of the processing carried out on the fibres by the licker-in, the drum and the processing cylinders it is currently necessary to
intervene on their rotation speed and/or on the processing means with which they are equipped.
The intervention requires a certain length of time for mutual calibration of the speeds on the basis of the new features to be given to the fibres at the outlet, and in any case so that the modifications made to the operational parameters of the machine are designed to obtain these new features.

Disclosure of the Invention
The aim of this invention is to provide a carding machine designed to vary the quality and in particular the intensity of the working of the fibres made by the machine, with a speed greater than that of the known techniques. This aim is achieved by means of a carding machine comprising a first rotary element or licker-in and a second rotary element or drum designed to form a first path for working the fibres tangential partly to the licker-in and partly to the drum and comprising a first intermediate sector passing through at least a first working point interposed between the licker-in and drum, characterised in that the licker-in and the drum rotate in same direction.

The machine may also comprise an rotary element which is able to adopt a rest condition and an operating condition, in accordance with which the auxiliary element, licker-in and drum define a second working path tangential partly to the licker-in and partly to the drum and comprising a second intermediate sector tangential to the auxiliary element, the second intermediate sector extending from a second working point interposed between the auxiliary element and licker-in to a third working point interposed between the auxiliary element and drum, the second intermediate sector being at least partly separate or alternative relative to the first intermediate sector.

A possible embodiment of the invention may comprise at least one of the following technical aspects.

Preferably, in the operating condition of the auxiliary element is tangential
to the licker-in and to the drum at, respectively, the second working point and the third working point. The auxiliary element is in this way designed to modify the working path that the fibres move along inside the machine, even if the second working path is, in any case, always at least partly tangential to the licker-in and at least partly tangential to the drum, like the first working path. Preferably, in its operating condition the auxiliary element is designed to pick up fibres from the licker-in at the second working point, and work them along the second intermediate sector, and transfer them on the drum at the third working point.

In a possible method of use of this invention, the licker-in and the drum rotate in the same direction to each other and on at least a same plane of rotation, whilst the auxiliary element rotates in the opposite direction to the licker-in and drum and also at least on the plane of rotation. According to this method, in the first working point, which belongs to the first working path which is in turn defined by the machine when the auxiliary element is in the rest condition, the directions of the speed associated respectively with the licker-in and the drum are different from each other, which makes the first working point a "hard" working point. The difference between the directions of these speeds is due to the difference between the directions of rotation, respectively, of the licker-in and the drum.

Again according to the method, in the second working point, which belongs to the second working path which is in turn defined by the machine when the auxiliary element is in the operating condition, the directions of the peripheral speeds associated respectively with the licker-in and the auxiliary element are different from each other, in particular due to the difference between the directions of rotation, respectively, of the licker-in and the auxiliary element.

In the same way, the directions of the peripheral speeds associated respectively with the drum and the auxiliary element, in the third working
point, are different from each other, due to the difference between the directions of rotation, respectively, of the drum and the auxiliary element. This means that when the auxiliary element adopts the operating condition, the fibres are induced to pass, rather than from the first "hard" working point, from two "soft" working points, which are, respectively, the second working point and the third working point, thereby obtaining a processing of these fibres which is less intense and generally speaking different in terms of quality.

Preferably, the machine comprises intermediate movement means designed for moving the auxiliary element between the rest condition and the operating condition.

Preferably, the intermediate movement means comprise an actuator of an electric or pneumatic type, and, if necessary, also guide means and/or supporting means of the auxiliary element.

Preferably, the movement of the auxiliary element between the rest condition and operating condition occurs towards and away from the first working point.

In this way, when the auxiliary element is tangential both to the licker-in and to the drum, the first working point is excluded from the working point which is covered by the fibres.

Preferably, the machine comprises an outfeed surface which may adopt several operating conditions in such a way as to be suitable for transferring fibres arriving from the drum alternatively towards one or other of successive components of a processing system comprising the machine according to this invention, based on the operating condition adopted by the outfeed surface.

Preferably, the drum is designed to convey the fibres towards the outfeed surface.

Preferably, the machine comprises an infeed surface which may adopt several operating conditions in such a way as to be suitable for conveying fibres at the infeed alternatively towards the licker-in so that they start to
travel along the first path or the second path, or towards one or other of successive components of a processing system comprising the machine according to this invention, based on the operating condition adopted by infeed surface.

5 In order to change the operating condition of the outfeed surface, and direct the fibres at the outfeed alternatively towards one or other of the components of the successive plant to the machine according to this invention, the machine preferably comprises outfeed movement means designed for moving the outfeed surface.

10 In order to change the operating condition of the infeed surface, and therefore direct fibres at the infeed alternatively towards the licker-in or directly towards one or the other of the components of the successive plant to the machine according to this invention, the machine preferably comprises infeed movement means designed for moving the infeed surface.

Preferably, the machine comprises rotary introductory elements designed to correctly direct the fibres at the infeed towards the licker-in, so that they start to travel along the first working path or the second working path.

Preferably, the machine comprises a rotary cleaning element designed to collect any fibres escaping from the first path or from the second path, to return them to the licker-in or on the drum in such a way that they move again, respectively, along the first path or along the second path.

Preferably, the cleaning element is tangential to the licker-in and drum respectively at two tangency points which, on a plane of rotation shared by the licker-in and drum and relative to the second working point and third working point, are situated on the opposite side to the first working point.

According to a possible method of use of this invention, the cleaning equipment rotates in the same direction as the auxiliary element and at least on the plane of rotation shared by the drum, licker-in and auxiliary element.
**Brief description of the drawings**

The features of this invention are described in detail below relating to a particular embodiment of the invention to be considered by way of a non-limiting example of the more general concepts claimed.

The detailed description which follows relates to the accompanying drawings, in which:

- Figure 1 is a view of a first operating configuration of a particular embodiment of this invention;
- Figure 2 is a view of a second operating configuration of a particular embodiment of this invention;
- Figure 3 is an enlargement of a part of this embodiment in the operating configuration of Figure 1;
- Figure 4 is an enlargement of a part of this embodiment in the operating configuration of Figure 2;
- Figure 5 is an explanatory view of the movements to which some parts of the machine can be subject;
- Figure 6 is a side view of this embodiment, practically from the opposite side with respect to the other drawings, once it has been inserted in a possible production plant also comprising other machines.

**Detailed description of preferred embodiments of the invention**

Figure 1 shows a carding machine 1 comprising a first rotary element or licker-in 2 and a second rotary element or drum 3, which are designed to form a first path L1 for working the fibres.

The first path L1 is tangential partly to the licker-in 2 and partly to the drum 3, and is shown in Figure 1 and partly in Figure 3.

The first working path L1 also comprises a first intermediate sector L1', shown in Figure 3, passing through at least a first working point P1 interposed between the licker-in 2 and the drum 3.

The machine 1 comprises an auxiliary rotary element 4 which is able to adopt a rest condition, shown in Figures 1 and 3, and an operating
condition, shown in Figures 2 and 4.
Practically, the first operating configuration of the machine 1, of Figures 1 and 3, corresponds to the rest condition of the auxiliary element 4. Practically, the second operating configuration of the machine 1, of Figures 2 and 4, corresponds to the operating condition of the auxiliary element 4.

When the auxiliary element 4 adopts its operating condition, it contributes to define, in conjunction with the licker-in 2 and the drum 3, a second working path L2, shown in Figure 2 and partly in Figure 4. The second working path L2 is also tangential partly to the licker-in 2 and partly to the drum 3, but comprises, instead of the first intermediate sector LV, a second intermediate sector L2', shown in Figure 4 and tangential to the auxiliary element 4.

As can be seen in particular in Figure 4, the second intermediate sector L2' extends from a second working point P2 interposed between the auxiliary element 4 and the licker-in 2, to a third working point P3 interposed between the auxiliary element 4 and the drum 3. As may be noted in particular by comparing Figures 3 and 4, the second intermediate sector L2' is at least partly separate or alternative relative to the first intermediate sector L1'.

In its operating condition, as can be seen in Figure 2 and in more detail in Figure 4, the auxiliary element 4 is tangential to the licker-in 2 and the drum 3, at, respectively, the second working point P2 and the third working point P3.

As it may be noted in particular in Figure 4, when it is in a working condition, the auxiliary element 4 is designed to pick up fibres from the licker-in 2 at the second working point P2, to convey them along the second intermediate sector L2', and then transfer them on the drum 3 at the third working point P3.

In the method of use according to this invention to which the accompanying drawings refer, the licker-in 2 and the drum 3 rotate in the
same direction to each other in the direction shown by the arrows A and B, on at least a same shared plane of rotation, which coincides with the plane of the accompanying drawings. The auxiliary element 4 rotates, however, in the opposite direction to the licker-in 2 and the drum 3, but also on at least the shared plane of rotation, as indicated by the arrow C.

The machine 1 preferably comprises intermediate movement means 5 designed for moving the auxiliary element 4 between its rest condition and its operating condition.

In the embodiment illustrated, the intermediate movement means 5 comprise an actuator 5a of an electric or pneumatic type, and, if necessary, also guide means 5b and/or supporting means 5c of the auxiliary element 4.

In this embodiment, as may be noted in particular from the comparison between Figures 3 and 4, the movement of the auxiliary element 4 between its rest condition and operating condition follows the double arrow D and towards and away from the first working point P1, which as mentioned above is interposed between the licker-in 2 and the drum 3. Figure 6 shows, on the other hand, a plant 1 in which this invention can be advantageously used, and which may comprise at least one other carding machine V, for example a forming machine F and/or a cutting unit T. The material being processed, shown only in Figure 6, is denoted with M, and comprises fibres preferably more or less discontinuous.

With reference in particular to Figures 1, 2, 5 and 6, in this embodiment the machine 1 comprises an infeed surface 6 which may adopt several operating conditions in such a way as to be suitable for conveying fibres alternatively towards the licker-in 2, so that the fibres start to travel along the first working path L1 or the second working path L2, or towards one or other of successive components of a processing system 1 comprising the machine 1.

In order to change the operating condition of the infeed surface 6, the machine 1 comprises infeed movement means designed for moving the
infeed surface 6. These infeed movement means, which are not shown for reasons of clarity of the drawings, may comprise for example an electric or pneumatic actuator and, in the embodiment illustrated determine the rotation or vertical translational of the infeed surface 6 according to the double arrow R1 of Figures 1, 2 and 5.

The images of the infeed surface 6 in Figures 1 and 5 correspond, respectively, to two possible operating conditions of the infeed surface 6. In Figure 2 the infeed surface 6 is in the same operating condition of Figure 1, since the difference between Figures 1 and 2 remains in the operating configuration of the machine 1 based on the positioning of the auxiliary element 4.

With reference in particular to Figures 1, 2, 5 and 7, in this embodiment the machine 1 comprises an outfeed surface 7 which may adopt several operating conditions in such a way as to be suitable for transferring fibres arriving from the drum 3, alternatively towards one or other of successive components of a processing system I comprising the machine 1. It is also considered that the drum 3 is preferably designed to convey the fibres towards the outfeed surface 7.

In order to change the operating condition of the outfeed surface 7, the machine 1 comprises outfeed movement means designed for moving the outfeed surface 7.

These outfeed movement means, which are not shown for reasons of clarity of the drawings, may comprise for example an electric or pneumatic actuator and, in the embodiment illustrated determine the rotation or vertical translational of the outfeed surface 7 according to the double arrow R2 of Figures 1, 2 and 5.

The images of the outfeed surface 7 in Figures 1 and 5 correspond, respectively, to two possible operating conditions of the outfeed surface 7. In Figure 2 the outfeed surface 7 is in the same operating condition of Figure 1, since the difference between Figures 1 and 2 remains in the operating configuration of the machine 1 based on the positioning of the
auxiliary element 4.

When the operating condition of Figures 1 and 2 is adopted, the infeed surface 6 is designed to carry the fibres towards the machine 1 according to this invention, and in particular towards the licker-in 2. Alternatively, in the operating condition in which there is the infeed surface 6 in Figure 5, the same infeed surface 6 is designed to avoid that the fibres are inserted into the machine 1, for example in such a way that they are directed directly towards the following the carding machine V of the system I of Figure 6, or directly towards cutting unit T of the system I.

In Figure 6, which illustrates an example of the plant I in which this invention can be advantageously used, the infeed surface 6 is located practically as shown in Figures 1 and 2.

It should be considered, however, that when the infeed surface 6 adopts the operating condition of Figure 5, the outfeed surface 7 must adopt a further operating condition, not illustrated in the drawings, designed to ensure that the outfeed surface 7 can receive the fibres that have not been worked by the machine 1.

For completeness of description, it should be noted that between the infeed surface 6 and the outfeed surface 7, as in the embodiment illustrated, there may be a further intermediate surface 8, preferably fixed and firmly attached to a part of the fixed frame of the machine 1. This intermediate surface 8 is used to pass the fibres from the infeed surface 6 to the outfeed surface 7 if the machine 1 according to this invention is to be bypassed.

When it adopts the operating condition of Figures 1 and 2, the outfeed surface 7 is designed, for example, to carry the fibres towards a following carding machine V of the same plant I of Figure 5. Alternatively, in the operating condition in which there is the outfeed surface 7 in Figure 5, the outfeed surface 7 is designed to carry the fibres directly towards the cutting unit T of the system I of Figure 5, in such a way as to bypass the machine 1'.
In Figure 6, which illustrates an example of the system I in which this invention can be advantageously used, the outfeed surface 7 is positioned practically as in Figure 5, to convey the fibres at the outfeed from the machine 1 directly towards cutting unit T of the system I.

In the embodiment of this invention illustrated in the drawings, the outfeed surface 7 is mounted preferably on two structures 9a and 9b which can move independently of each other according to, respectively, the double arrows E, G. The structures 9a and 9b can also translate together, in such a way that the outfeed surface 7 translates vertically without rotating. The translation of both the structures 9a and 9b downwards may serve, for example, if the fibres are to bypass both carding machines 1 and V of the plant I of Figure 6.

Moreover, the infeed surface 6 and the outfeed surface 7 preferably translate parallel to themselves according to, for example, the arrow H and the arrow N, respectively, in order to move the fibres.

These infeed 6 and outfeed 7 surfaces each preferably comprise a conveyor belt placed in motion by rollers.

Also, any intermediate surface 8 translates parallel to itself and preferably comprises a conveyor belt moved by rollers.

The machine 1 also advantageously comprises rotary introductory elements 10 designed to correctly direct towards the licker-in 2 the fibres, which arrive according to the arrow H of Figure 1 or 2 if necessary after being fed out from the forming machine F in Figure 6.

By means of the introductory elements 10, the same fibres may correctly follow the first working path L1 or the second working path L2, selected on the basis of the rest or operating condition which the auxiliary element 4 adopt.

The embodiment of the machine 1 shown in the accompanying drawings advantageously also comprises a rotary cleaning element 11 designed to collect any fibres escaping from the first path L1 or from the second path L2, to return them on the licker-in 2 or on the drum 3, in such a way that
they move again, respectively, along the first path L1 or along the second
path L2.
The cleaning element 11 is advantageously tangential to the licker-in 2
and to the drum 3 at two tangential points Q and Y, respectively. The
tangential points Q and Y, on the plane of rotation shared by the licker-in 2
and the drum 3 and relative to the working points P2 and P3 are
positioned on the opposite side of the first working point P1.
In the method of use according to the accompanying drawings, the
cleaning element 11 also rotates in the same direction as the auxiliary
element 4, as shown by the arrow W, and also at least on the shared
plane of rotation.
In the embodiment illustrated there are also an upper suction element 12
and a lower suction element 13, situated on opposite sides of the outfeed
surface 7, which work the fibres with air techniques. The upper suction
element 12 is also preferably rotatable, on the plane of rotation, as
indicated by the arrow U, to contribute to the movement of the fibres
parallel to the outfeed surface 7.
The invention makes it possible to achieve the preset aims.
The auxiliary element 4 allows a second working path L2 of the fibres to be
selected at least partly different from the first working path L1, and
therefore to modify the quality and/or the intensity of the processing of the
fibres, more quickly than the prior art techniques, in such a way as to
quickly obtain predetermined changes in the characteristics of the layer or
stream of fibres at the outfeed.
Moreover, the configuration of the auxiliary element 4 also allows a certain
versatility of the machine 1, on which more auxiliary elements 4 of different
dimensions can also be mounted alternatively in such a way as to form
different processing intensities and/or qualities, and in any case the
machine is also suitable for a convenient replacement of the auxiliary
element 4 for being able to obtain other types of machining operations.
It is also possible to minimise the waste due to the rejection of material
which accidentally escapes from the working path L1 or L2, using a cleaning element 11 which efficiently acts in conjunction with the other components of the machine.
CLAIMS

1. A carding machine (1) comprising a first rotary element or licker-in (2) and a second rotary element or drum (3) designed to form a first path (L1) for working the fibres tangential partly to the licker-in (2) and partly to the drum (3) and comprising a first intermediate sector (Ι₁’) passing through at least a first working point (P1) interposed between the licker-in (2) and drum (3), characterised in that the licker-in (2) and the drum (3) rotate in same direction, wherein the machine (1) also comprises an auxiliary rotary element (4) which is able to adopt a rest condition and an operating condition, in accordance with which the auxiliary element (4), licker-in (2) and drum (3) form a second working path (L2) tangential partly to the licker-in (2) and partly to the drum (3) and comprising a second intermediate sector (Ι₂’) tangential to the auxiliary element (4), the second intermediate sector (Ι₂’) extending from a second working point (P2) interposed between the auxiliary element (4) and licker-in (2) to a third working point (P3) interposed between the auxiliary element (4) and drum (3), the second intermediate sector (Ι₂’) being at least partly separate or alternative to the first intermediate sector (L1’), wherein the machine comprises intermediate movement means (5) designed for moving the auxiliary element (4) between the rest condition and the operating condition, and wherein the machine is characterised in that the movement of the auxiliary element (4) between the rest condition and the operating condition occurs towards and away from the first working point (P1).

2. The machine (1) according to claim 1, wherein in the operating condition of the auxiliary element (4) is tangential to the licker-in (2) and to the drum (3) at, respectively, the second working point (P2) and the third working point (P3).

3. The machine (1) according to claim 1 or 2, wherein in the operating condition the auxiliary element (4) is designed to pick up fibres from the licker-in (2) at the second point (P2), and work them along the second
intermediate sector (L2′), and transfer them on the drum (3) at the third
point (P3).
4. The machine (1) according to any one of the preceding claims,
comprising an outfeed surface (7), which may adopt several operating
conditions in such a way as to be suitable for transferring fibres arriving
from the drum (3) alternatively towards one or other of successive
components (1′, T) of a processing system (I) comprising the machine (1),
based on the operating condition adopted by the outfeed surface (7), the
drum (2) being designed to convey the fibres towards the outfeed surface
(7).
5. The machine (1) according to any one of the preceding claims,
comprising an infeed surface (6) which may adopt several operating
conditions in such a way as to be suitable for conveying fibres alternatively
towards the licker-in (3) so that they start to travel along the first working
path (L1) or the second working path (L2), or directly towards one or other
of successive components (1′, T) of a processing system (I) comprising
the machine (1).
6. The machine (1) according to claim 4 or 5, comprising outfeed
movement means and infeed movement means designed for moving,
respectively, the outfeed surface (7) and/or the infeed surface (6), for
modifying the adopted operating condition.
7. The machine (1) according to any one of the preceding claims,
comprising rotary introductory elements (10) designed to correctly direct
fibres at infeed towards the licker-in (2), so that they start to travel along
the first working path (L1) or the second working path (L2).
8. The machine (1) according to any one of the preceding claims,
comprising a rotary cleaning element (11) designed to collect any fibres
escaping from the first working path (L1) or from the second working path
(L2) to return them to the licker-in (2) or to the drum (3) in such a way that
they move again, respectively, along the first working path (L1) or the
second working path (L2).
9. The machine (1) according to claim 8, wherein the cleaning element (10) is tangential to the licker-in (2) and drum (3) respectively at two tangency points (Q, Y) which, on a plane of rotation shared by the licker-in (2) and drum (3) and relative to the second working point (P2) and third working point (P3), are situated on the opposite side to the first working point (P1).

10. A method of using a carding machine (1) according to any one of the preceding claims, wherein the licker-in (2) and drum (3) rotate in the same direction as each other and on at least one same plane of rotation.

11. The method of use according to claim 10, wherein the auxiliary element (4) rotates in the opposite direction to the licker-in (2) and drum (3) and at least on the plane of rotation.

12. The method of use of a machine (1) according to claim 10 or 11, wherein the cleaning element (11) rotates in the same direction as the auxiliary element (4) and at least on the plane of rotation.
# INTERNATIONAL SEARCH REPORT

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column 1, lines 15-24; figure 1

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page 1, lines 46-121; figure 2

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28 February 2006 (2006-02-28)

column 3, line 4 - column 4, line 34;
figures 2-5

**A**

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