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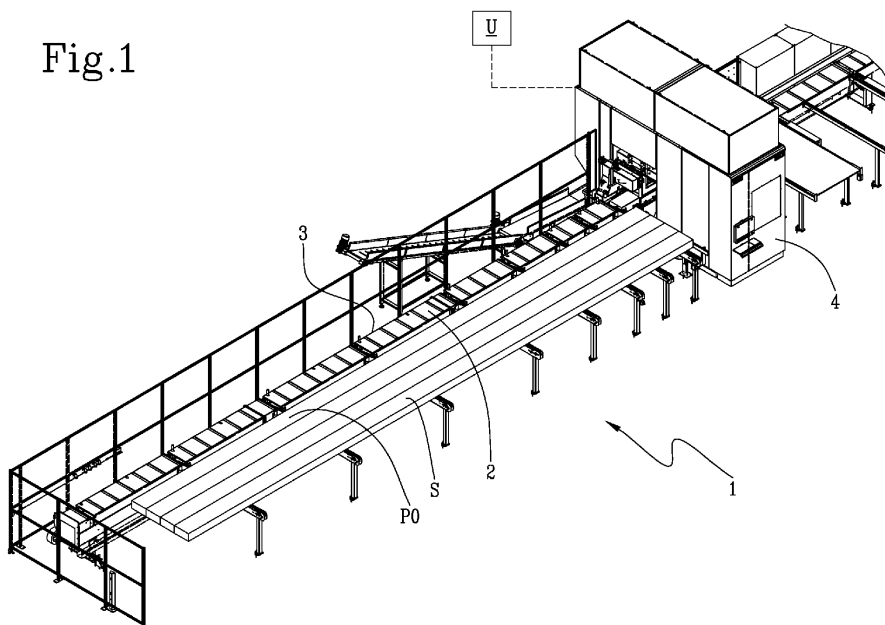
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MACHINE TOOL AND METHOD FOR WORKING WOODEN ELONGATED WORKPIECES
- (57)

A machine tool (1) for machining elongated, wooden semiproducts, comprising a loading station (2) provided with a first conveyor (10) configured for transversely conveying a succession (S) of juxtaposed semiproducts along a loading path (R1) and a second conveyor (20), located downstream of the first conveyor (10) along the loading path (R1), configured to withdraw the leading semiproduct (P0) from the withdrawal area (A1), separating the leading semiproduct (P0) from the succession (S) of semiproducts and to convey the leading semiproduct (P0) transversely along the loading path (R) from the withdrawal area (A1) to a feed area (A2), the second conveyor (20) defining a second supporting surface for the semiproducts, configured to be overlaid on the first supporting surface in the withdrawal area (A1). The machine tool (1) comprises a control unit (U), connected to the conveyors (10, 20) and configured to receive operating data representing a transverse dimension (T) of the leading semiproduct (P0) and to control at least one between the first and the second conveyor (10, 20) by assigning a predetermined stroke to it as a function of the operating data.
- Fig.1
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Description

[0001] This invention relates to a machine tool and a method for machining elongated wooden semiproducts.

[0002] This invention addresses the manufacturing industry and is applicable in particular to the field of wood-working.

[0003] In this disclosure, the expression "elongated" is used to refer to a product which has a dimension that is predominant over the others, that is to say, a product which extends predominantly along a main axis. In particular, the expression "elongated" is used to refer to wooden boards or wooden planks. In the field relevant to this invention, woodworking machines are known which essentially comprise a loading station, a feed station and a station for machining the semiproducts.

[0004] The loading station comprises a first conveyor configured to convey a succession of juxtaposed semiproducts along a loading path up to a feeding area in the proximity of the feed station. Typically, the first conveyor is of the type with a conveyor belt defining a supporting surface for the semiproducts. At a functional level, the semiproducts are loaded onto the first conveyor which moves them along the loading path so as to pack them closely together in succession in the proximity of a withdrawal area. In other words, in the proximity of the withdrawal area, the semiproducts are juxtaposed and abutted against each other.

[0005] The feed station comprises a second conveyor configured to separate the leading semiproduct from the succession of semiproducts and to convey it longitudinally along a feed path towards the machining station. Structurally, the second conveyor comprises a motor-driven roller configured to engage the top of the leading semiproduct and to move it longitudinally along said feed path.

[0006] An example of a machine of this kind is described in document EP0988924. Another example of a machine of this kind is described in document DE102021125391.

[0007] The Applicant has observed that even in their more modern implementations, machines of the type described above have some disadvantages of a functional and/or structural nature which means that using them is not free of drawbacks.

[0008] Firstly, when the second conveyor separates the leading semiproduct, the friction created between the semiproducts may cause the leading semiproduct to drag the adjacent semiproduct along with it in the direction of the machining station.

[0009] Secondly, since these machines are used for semiproducts of different sizes (in particular, having different transverse dimensions), the motor-driven roller of the second conveyor may accidentally also engage the second semiproduct of the succession and move it in the direction of the machining station.

[0010] As a result, one or more of the following problems may occur.

[0011] Reduced precision: the semiproducts are positioned imprecisely in the machining station and the machine process performed on them is imprecise.

[0012] Possible machine blockage: the two semiproducts fed in simultaneously may get jammed in the machine tool, preventing the system from operating correctly. This may require extraordinary action to be taken by operators, placing an extra burden on the machining process in terms of time and costs.

[0013] Damage to the machine tool: feeding two semiproducts simultaneously could lead to premature wear or breakage of mechanical components of the machine tool, thus reducing its working life and functionality.

[0014] In this context, the basic technical purpose of this invention is to provide a machine tool and a method for machining elongated wooden semiproducts and which are free of the above mentioned drawbacks of the prior art.

[0015] This invention therefore has for an aim to provide a machine tool and a method for machining elongated wooden semiproducts to ensure that the semiproducts are fed correctly to the machining station.

[0016] Another aim of this invention, therefore, is has to provide a machine tool and a method for machining elongated wooden semiproducts to allow protecting the structural integrity of the machine tool.

[0017] Another aim of this invention, therefore, is has to provide a machine tool and a method for machining elongated wooden semiproducts to allow the structure of the machine tool to not be excessively complicated and/or to not increase its construction costs.

[0018] The technical purpose and aims specified are substantially achieved by a machine tool for machining elongated wooden semiproducts, comprising the technical features described in one or more of the appended claims. The dependent machine tool claims correspond to possible embodiments of the invention.

[0019] The technical purpose and aims specified are also substantially achieved by a method for machining elongated wooden semiproducts, comprising the technical features described in one or more of the appended claims. The method is, in particular, implemented by the aforesaid machine tool for machining elongated, wooden semiproducts. The dependent method claims correspond to possible embodiments of the invention.

[0020] The machine tool comprises a semiproduct loading station.

[0021] The loading station comprises a first conveyor, configured for conveying a succession of juxtaposed semiproducts transversely along a loading path so as to cyclically position a leading semiproduct of the succession in a withdrawal area.

[0022] In other words, there is a step of conveying a succession of juxtaposed semiproducts transversely along a loading path via the first conveyor to cyclically position a leading semiproduct of the succession in a withdrawal area.

[0023] The first conveyor may also be configured for

conveying a succession of juxtaposed packs or stacks of semiproducts transversely along the loading path so as to cyclically position a leading pack or stack in a withdrawal area. The terms "packs" or "stacks" of semiproducts are used to refer to a set of elongated semiproducts which are stacked or placed on top of one another to form a substantially rectangular block. The size and number of semiproducts in a pack or stack of semiproducts may vary according to specific industry or project requirements. As this description continues, reference will be made exclusively to "succession of semiproducts" or "leading semiproduct" for convenience of description. According to the generality of the disclosure, however, the same concepts described for the succession of semiproducts and for the leading semiproduct also apply to the succession of packs or stacks of semiproducts and to the leading pack or stack, without thereby departing from the scope of this disclosure.

[0024] In this description, the expression "leading semiproduct" is used to mean the first item in the succession of semiproducts located in the loading station with reference to the direction of the loading path. As will become clearer as this description continues, once the leading semiproduct has been processed by the loading station and sent to the next station, the semiproduct just upstream of the current leading semiproduct (along the loading path) becomes the "new" leading semiproduct.

[0025] Also, the term "transversely" is used to mean a direction substantially transverse, preferably perpendicular, to the predominant direction of extension of the semiproducts.

[0026] The first conveyor defines a first supporting surface for the semiproducts.

[0027] In an embodiment, the first conveyor comprises a conveyor belt. In particular, the conveyor belt may be of the slat type. In another example, the first conveyor may comprise a chain conveyor. In another example, the first conveyor may comprise a roller conveyor.

[0028] The choice as to the type of conveyor depends on specific production requirements and on the type of semiproduct to be processed.

[0029] The loading station comprises a second conveyor, located downstream of the first conveyor along the loading path.

[0030] The second conveyor is configured to withdraw the leading semiproduct from the withdrawal area, thus separating the leading semiproduct from the succession of semiproducts.

[0031] The second conveyor is also configured to convey the leading semiproduct transversely along the aforesaid loading path from the withdrawal area to a feed area in proximity to a feed station.

[0032] The second conveyor defines a second supporting surface for the semiproducts, configured to be overlaid on the first supporting surface in the withdrawal area.

[0033] In other words, there is a step of withdrawing the leading semiproduct from the withdrawal area, thus

separating it from the succession of semiproducts by means of the second conveyor and conveying the leading semiproduct transversely along the loading path from the withdrawal area to the feed area by means of the second conveyor.

[0034] The term "overlaid" is used to mean that in at least one operating configuration, the first and the second conveyors are configured to intersect or interpenetrate each other (with reference to the loading path) so that the two supporting surfaces at least partly coincide and have a surface portion in common.

[0035] According to an aspect of this disclosure, irrespective of the type of second conveyor, the second conveyor moves at a feed speed that is greater than or equal to the feed speed of the first conveyor.

[0036] In an embodiment, the second conveyor comprises a conveyor belt. In particular, the conveyor belt is a slat or chain conveyor. In another example, the second conveyor may comprise a roller conveyor. In these embodiments, the second conveyor is substantially parallel to the first conveyor.

[0037] In an alternative embodiment, the second conveyor comprises a conveyor pad defining the aforesaid second supporting surface and a drive mechanism configured to move the conveyor pad along a closed path passing through the withdrawal area and the feed area. In particular, the pad is configured to be moved cyclically between the withdrawal area, where it withdraws the leading semiproduct, and the feed area, where it unloads the leading semiproduct. In other words, the closed path has a first dead centre in proximity to the withdrawal area and a second dead centre in proximity to the feed area.

[0038] In an example, the closed path of the pad can extend on one level only, in particular so that the pad follows a periodic or alternate linear movement between the withdrawal area and the feed area. In another example, the closed path of the pad can extend on at least two levels, as will become clearer as this description continues. In this disclosure, the term "level" is used to refer to the height of the pad relative to a reference plane such as, for example, the floor.

[0039] Whatever the type of first conveyor and second conveyor, the machine tool comprises a feed station, located downstream of the loading station along the aforesaid loading path.

[0040] The feed station comprises a third conveyor, located downstream of the second conveyor along the loading path and configured to convey the singulated semiproduct longitudinally along a feed path from the feed area to a machining station of the machine tool. The term "longitudinally" is used to mean a direction substantially parallel to the predominant direction of extension of the semiproducts.

[0041] In particular, the third conveyor is configured to receive the leading semiproduct from the second conveyor and to convey that semiproduct to the machining station of the machine tool.

[0042] In other words, there is a step of conveying the

leading semiproduct longitudinally along the feed path from the feed area to the machining station by means of the third conveyor.

[0043] In an embodiment, the third conveyor comprises gripping elements, such as clamps, configured to grip and move the leading semiproduct longitudinally along the feed path up to the machining station. In an embodiment, the third conveyor comprises pushing elements to engage and move the leading semiproduct longitudinally along the feed path up to the machining station. Whatever the type of movement elements, the third conveyor may also comprise a slide top, located downstream of the second conveyor along the loading path and configured to receive the leading semiproduct transported by the second conveyor. The slide top defines a third supporting surface configured to be overlaid on the second supporting surface in the feed area. The term "overlaid" is used to mean that in at least one operating configuration, the second and third conveyors are configured to intersect or interpenetrate each other so that the two supporting surfaces at least partly coincide and have a surface portion in common.

[0044] Moreover, when present, this slide top defines the aforesaid feed path.

[0045] At a functional level, the slide top slidably supports the semiproduct transported by the gripping elements along the feed path. In an example, the slide top may comprise a substantially planar supporting surface. In another example, the slide top may comprise an idle roller table.

[0046] In alternative embodiments of the third conveyor, it may comprise a slat conveyor, a chain conveyor or a roller conveyor. The choice as to the type of conveyor depends on specific production requirements and on the type of semiproduct to be processed.

[0047] Irrespective of how the third conveyor is made, the third conveyor may comprise at least one limit stop, configured to stop the transverse movement of the leading semiproduct in the feed area. The at least one limit stop is thus configured to stop the semiproduct being moved by the second conveyor. In other words, the at least one limit stop defines the end of the loading path. The at least one limit stop may be of a fixed or selectively retractile type.

[0048] According to an aspect of this disclosure, the machine tool comprises a control unit, connected to the loading, feed and machining stations. In particular, the control unit is connected to the conveyors. The control unit is configured to receive operating data representing a transverse dimension of the leading semiproduct.

[0049] The expression "transverse dimension" is used to mean, in particular, the width of the semiproducts.

[0050] In an embodiment, the machine tool may comprise at least one measuring sensor, connected to the control unit and configured to capture at least one measurement of the transverse dimension of the leading semiproduct and to generate the aforesaid operating data representing the transverse dimension of the leading

semiproduct and to send the operating data to the control unit.

[0051] Irrespective of the presence of the measuring sensors, the machine tool may comprise a user interface device, connected to the control unit and configured to receive as input at least one measurement of the transverse dimension of the leading semiproduct and to generate the aforesaid operating data representing the transverse dimension of the leading semiproduct and to send the data to the control unit.

[0052] According to an aspect of this disclosure, whatever the origin of the operating data, the control unit is configured to control at least one between the first and the second conveyor by assigning a predetermined stroke to it as a function of the operating data.

[0053] In other words, at least one between the first conveyor and the second conveyor performs a predetermined stroke as a function of the operating data representing the transverse dimension of the leading semiproduct.

[0054] In an embodiment, the control unit may be configured to drive the first conveyor for a stroke not greater than the width of the leading semiproduct by moving the leading semiproduct along the loading path so as to position the leading semiproduct in the withdrawal area and at least partly on the second supporting surface of the second conveyor.

[0055] In other words, the first conveyor is driven in such a way as move the leading semiproduct along the loading path for a stroke not greater than the transverse dimension of the leading semiproduct so as to position the leading semiproduct in the withdrawal area.

[0056] Once the leading semiproduct has been made to advance according to this stroke and is positioned in the withdrawal area at least partly on the second supporting surface of the second conveyor, whatever the structure of the second conveyor, the second conveyor withdraws that semiproduct and moves it along the loading path, thus separating it from the rest of the succession of semiproducts. In particular, in the withdrawal area, the leading semiproduct is supported simultaneously by the first supporting surface and by the second supporting surface.

[0057] Advantageously, since the semiproduct has been made to advance for a stroke that is less than or equal to its transverse dimension, the second conveyor will engage only the leading semiproduct without also moving the semiproduct directly upstream of the leading semiproduct along the loading path.

[0058] In an embodiment, if the second conveyor comprises the conveyor pad and the drive mechanism of the conveyor pad, the control unit may be configured to drive the first conveyor for the length of a stroke such as to position the semiproduct so that at the front (with reference to the loading path) it is aligned with a withdrawal position. This withdrawal position is independent of the transverse dimension of the leading semiproduct. In effect, this stroke may be longer than the transverse di-

mension of the leading semiproduct itself. For this purpose, optical sensors may be provided to stop the movement of the first conveyor when the front portion of the leading semiproduct is aligned with the withdrawal position. At the same time, in this embodiment, the control unit is configured to define the closed path of the conveyor pad of the second conveyor as a function of the transverse dimension of the leading semiproduct so that the pad can engage and withdraw only that semiproduct. In particular, the control unit is configured in such a way that, in the withdrawal area, the second supporting surface of the second conveyor interpenetrates the first supporting surface for a stretch not greater than the transverse dimension of the leading semiproduct to be withdrawn.

[0059] In other words, the second conveyor comprises a conveyor pad movable cyclically along a closed path passing through the withdrawal area and the feed area: in the withdrawal area, the conveyor pad is configured to at least partly interpenetrate the first conveyor for a stretch not greater than the transverse dimension of the leading semiproduct.

[0060] Advantageously, since the second supporting surface of the second conveyor has interpenetrated the first supporting surface for a stretch less than or equal to the transverse dimension of the leading semiproduct, the pad will engage only the leading semiproduct without also moving the semiproduct directly upstream of the leading semiproduct along the loading path.

[0061] According to an aspect of this disclosure, whatever the structure of the first and second conveyors, before the leading semiproduct is transferred from the first to the second conveyor, the leading semiproduct is supported simultaneously by the first supporting surface and by the second supporting surface.

[0062] Once the leading semiproduct has been transferred from the first to the second conveyor, the second conveyor moves the leading semiproduct along the loading path towards the feed station.

[0063] According to an aspect of this disclosure, the second conveyor is configured to be switchable between a raised configuration and a lowered configuration. In other words, the second conveyor is switched cyclically between a raised configuration and a lowered configuration.

[0064] In the embodiment in which the second conveyor is a conveyor belt, the second conveyor is configured to be switchable between a raised configuration of the conveyor belt suitable for withdrawing and transporting the leading semiproduct, where the second supporting surface is coplanar with the first supporting surface and is raised and parallel with respect to the third supporting surface of the third conveyor, and a lowered configuration of the conveyor belt, suitable for unloading the leading semiproduct transported into the feed area, where the second supporting surface is lowered at least with respect to the third supporting surface of the third conveyor.

[0065] In an example, the first conveyor and the sec-

ond conveyor are connected to the same shaft located in proximity to the withdrawal area. In particular, this shaft acts as a drive shaft for the second conveyor and as an idle supporting shaft for the first conveyor: in other words, the second conveyor is integral with the shaft, whereas the first conveyor is connected to the shaft via bearings and thus rotates idly and not as one with the shaft. Advantageously, the shaft keeps the centres of rotation of the two conveyors aligned with each other.

[0066] In this example, the second conveyor is rotatable about an axis of rotation passing through the shaft so that the raised configuration and the lowered configuration are defined by a tilting movement of the second conveyor. In other words, in the raised configuration the second supporting surface is coplanar with the first supporting surface and is raised and preferably parallel to the third supporting surface whereas in the lowered configuration, the second supporting surface is inclined relative to the first supporting surface and the third supporting surface.

[0067] At a functional level, the second conveyor withdraws and transports the leading semiproduct from the withdrawal area to the feed area in the raised configuration, where the second supporting surface of the second conveyor is substantially coplanar with the first supporting surface. Once the leading semiproduct has reached the feed area, where the leading semiproduct is supported by the second surface of the second conveyor, the second conveyor adopts the lowered configuration so that the second supporting surface disengages the leading semiproduct, which is then supported only by the third supporting surface of the third conveyor. When the leading semiproduct is moved from the feed area to the machining station by the third conveyor, the second conveyor is switched to the raised configuration again.

[0068] In the embodiment in which the second conveyor comprises the aforesaid conveyor pad and the drive mechanism of the conveyor pad, the drive mechanism defines a raised configuration of the conveyor pad suitable for withdrawing and transporting the leading semiproduct along the loading path, where the second supporting surface is raised with respect to the first supporting surface and the third supporting surface, and a lowered configuration of the conveyor pad, suitable for unloading the semiproduct transported into the feed area onto the third supporting surface, where the second supporting surface is lowered with respect to the first supporting surface and the third supporting surface.

[0069] In other words, the conveyor pad is moved by its drive mechanism along a closed path which extends on at least two levels: in the raised configuration, the conveyor pad is located at a first level, whereas in the lowered configuration, the conveyor pad is located at a second level, lower than the first level.

[0070] At a functional level, the conveyor pad reaches the withdrawal area in the lowered configuration. After reaching the withdrawal area, the conveyor pad is switched from the lowered configuration to the raised

configuration. In the movement from the lowered configuration to the raised configuration, the second conveyor surface, which is at least partly interpenetrated in the first supporting surface, engages the bottom of the leading semiproduct and lifts it off, and separates it from, the first supporting surface. At this point, the conveyor pad moves the leading semiproduct along the loading path from the withdrawal area to the feed area. After reaching the feed area, the conveyor pad is switched from the raised configuration to the lowered configuration. In the movement from the raised configuration to the lowered configuration, the second conveyor surface, which is at least partly interpenetrated in the third supporting surface, disengages the leading semiproduct, which is now supported only by the third supporting surface.

[0071] Once in the lowered configuration, the conveyor pad is moved from the feed area to the withdrawal area by its drive mechanism.

[0072] According to an aspect of this disclosure, the first conveyor comprises retractile limit stops located on the first supporting surface in proximity to the withdrawal area and configured to adopt a first, extracted configuration in which they stop the succession of semiproducts moving along the loading path, and a retracted configuration in which they allow the succession of semiproducts to move along the loading path.

[0073] Further features and advantages of the present invention are more apparent in the exemplary, hence non-limiting description of an embodiment of a machine tool and a method for machining elongated wooden semiproducts. The description is set out below with reference to the accompanying drawings which are provided solely for purposes of illustration without limiting the scope of the invention and in which:

- Figure 1 shows a perspective view of an exemplary, hence non-limiting, preferred embodiment of a machine tool for machining elongated wooden semiproducts in accordance with this disclosure;
- Figure 2 shows a perspective view of a component of the embodiment of the machine tool of Figure 1, in a first operating configuration;
- Figure 3 shows a perspective view of a component of the embodiment of the machine tool of Figure 1, in another operating configuration;
- Figure 4 shows a perspective view of a component of the embodiment of the machine tool of Figure 1, in another operating configuration.

[0074] The reference numeral 1 in the accompanying drawings denotes in its entirety a machine tool (represented schematically and only partly in the accompanying drawings) for machining elongated wooden semiproducts. The machine tool 1 is applicable in the manufacturing industry and is used in particular in the field of woodworking.

[0075] In this disclosure, the expression "elongated" is used to refer to a product which has a dimension that is

predominant over the others, that is to say, a product which extends predominantly along a main axis. In particular, the expression "elongated" is used to refer to wooden boards or wooden planks. As illustrated in the drawings, the machine tool 1 comprises a loading station 2, a feed station 3, a machining station 4 and a control unit U connected to the three stations 2, 3, 4.

[0076] The loading station 2 comprises a first conveyor 10 configured for transversely conveying a succession S of juxtaposed semiproducts along a loading path R1 so as to cyclically position a leading semiproduct P0 of the succession S in a withdrawal area A1. The first conveyor 10 defines a first supporting surface for the semiproducts.

[0077] In an alternative embodiment not illustrated, the first conveyor 10 may also be configured for conveying a succession S of juxtaposed packs or stacks of semiproducts transversely along the loading path R1 so as to cyclically position a leading pack or stack in the withdrawal area A1. The term "pack" or "stack" of semiproducts is used to refer to a set of elongated semiproducts which are stacked or placed on top of one another to form a substantially rectangular block. The size and number of semiproducts in a pack or stack of semiproducts may vary according to specific industry or project requirements. As this description continues, reference will be made exclusively to "succession S of semiproducts" or "leading semiproduct P0" for convenience of description. According to the generality of the disclosure, however, the same concepts described for the succession S of semiproducts and for the leading semiproduct P0 also apply to the succession of packs or stacks of semiproducts and to the leading pack or stack, without thereby departing from the scope of this disclosure.

[0078] With reference to Figures 2-4, the first conveyor 10 comprises a conveyor belt 11. In particular, the conveyor belt 11 may be of the slat type. Alternatively, the conveyor belt 11 may be a chain conveyor or a roller conveyor.

[0079] The choice as to the type of conveyor depends on specific production requirements and on the type of semiproduct to be processed.

[0080] The first conveyor 10 also comprises retractile limit stops 12 located on the first supporting surface in proximity to the withdrawal area A1 and configured to adopt a first, extracted configuration in which they stop the succession S of semiproducts moving along the loading path R1, and a retracted configuration in which they allow the succession S of semiproducts to move along the loading path R1, as will become clearer as this description continues.

[0081] The loading station 2 comprises a second conveyor 20, located downstream of the first conveyor 10 along the loading path R1.

[0082] The second conveyor 20 is configured to withdraw the leading semiproduct P0 from the withdrawal area A1, thus separating the leading semiproduct P0 from the succession S of semiproducts. The second con-

veyor 20 is also configured to convey the leading semiproduct P0 transversely along the aforesaid loading path R1 from the withdrawal area A1 to a feed area A2. Structurally, the second conveyor 20 defines a second supporting surface for the semiproducts, configured to be overlaid on the first supporting surface in the withdrawal area A1.

[0083] The term "overlaid" is used to mean that in at least one operating configuration, the first and second conveyors 10, 20 are configured to intersect or interpenetrate each other so that the two supporting surfaces at least partly coincide and have a surface portion in common.

[0084] With reference to the preferred embodiment, illustrated for exemplary, hence non-limiting purposes in Figures 2-4, the second conveyor 20 comprises a conveyor belt 21. In particular, the conveyor belt 21 is of the slat type. Alternatively, the conveyor belt 21 may be a chain conveyor or a roller conveyor.

[0085] The choice as to the type of conveyor depends on specific production requirements and on the type of semiproduct to be processed.

[0086] The second conveyor 20 is substantially parallel to the first conveyor 10. Preferably, the second conveyor 20 moves at a feed speed that is greater than or equal to the feed speed of the first conveyor 10.

[0087] The feed station 3 is located downstream of the loading station 2 along the loading path R1.

[0088] The feed station 3 comprises a third conveyor 30, located downstream of the second conveyor 20 along the loading path R1. The third conveyor 30 is configured to convey the leading semiproduct P0 longitudinally along a feed path R2 from the feed area A2 to the machining station 4 of the machine tool 1.

[0089] In particular, the third conveyor 30 is configured to receive the leading semiproduct P0 from the second conveyor 20 and to convey the semiproduct P0 to the machining station 4 of the machine tool 1.

[0090] In an embodiment, the third conveyor 30 comprises gripping elements (not illustrated), such as clamps, configured to grip and move the leading semiproduct P0 longitudinally along the feed path A2 up to the machining station 4.

[0091] In the embodiment illustrated in the accompanying drawings, the third conveyor 30 also comprises a slide top 31, located downstream of the second conveyor 20 along the loading path R1 and configured to receive the leading semiproduct P0 transported by the second conveyor 20. The slide top 31 defines a third supporting surface configured to be overlaid on the second supporting surface in the feed area A2.

[0092] The term "overlaid" is used to mean that in at least one operating configuration, the second and third conveyors 20, 30 are configured to intersect or interpenetrate each other (with reference to the loading path R1) so that the two supporting surfaces at least partly coincide and have a surface portion in common.

[0093] Also, the slide top 31 defines the aforesaid feed

path R2.

[0094] At a functional level, the slide top 31 supports the leading semiproduct P0 transported by the gripping elements along the feed path R2.

5 **[0095]** The third conveyor 30 also comprises at least one limit stop 32, configured to stop the transverse movement of the leading semiproduct P0 in the feed area A2, as will become clearer as this description continues.

10 **[0096]** According to an aspect of this disclosure, the second conveyor 20 is configured to be switchable between a raised configuration and a lowered configuration.

[0097] In particular, the raised configuration of the second conveyor 20 is suitable for withdrawing and transporting the leading semiproduct P0: in this configuration, the second supporting surface is coplanar with the first supporting surface of the first conveyor 10 and parallel and raised with respect to the third supporting surface of the third conveyor 30. Specifically, in this configuration, the second supporting surface is at a higher level than the third supporting surface, the difference in level being between 10 mm and 50 mm, preferably 30 mm. This configuration is illustrated in Figures 2 and 4.

20 **[0098]** The lowered configuration of the second conveyor 20 is suitable for unloading the leading semiproduct P0 transported into the feed area A2: in this configuration, the second supporting surface is lowered at least with respect to the third supporting surface of the third conveyor 30 so as to unload the leading semiproduct P0 onto the third conveyor 30. This configuration is illustrated in Figure 3.

30 **[0099]** In the embodiment illustrated in the accompanying drawings, the first conveyor 10 and the second conveyor 20 are connected to the same shaft 15 located in proximity to the withdrawal area A1.

35 **[0100]** In this embodiment, the second conveyor 20 is integral with the shaft 15, which acts as drive shaft for the second conveyor 20. Furthermore, the first conveyor 10 is idly connected to the shaft 15 by means of bearings so that the conveyor 10 can rotate but not as one with the shaft 15. Advantageously, the shaft 15 allows keeping the centres of rotation of the two conveyors 10, 20 aligned with each other so that the two conveyors 10, 20 cooperate in optimum manner. In effect, this technical feature allows stabilizing both the raised configuration and the lowered configuration, as will become clearer as this description continues.

40 **[0101]** In effect, the second conveyor 20 is rotatable about an axis of rotation X passing through the shaft 15 so that the raised configuration and the lowered configuration are defined by a tilting movement of the second conveyor 20. In other words, the second conveyor is tiltable between the raised configuration and the lowered configuration about the axis of rotation X passing through the shaft 15.

45 **[0102]** In other words, in the raised configuration the second supporting surface is coplanar with the first supporting surface and is parallel and raised with respect to the third supporting surface whereas in the lowered con-

figuration, the second supporting surface is inclined relative to the first supporting surface and the third supporting surface.

[0103] According to an aspect of this disclosure, the control unit U is connected to the conveyors 10, 20, 30. In particular, the control unit U is configured to receive operating data representing a transverse dimension T of the leading semiproduct P0.

[0104] The expression "transverse dimension" is used to mean, in particular, the width of the leading semiproduct P0.

[0105] Preferably, the machine tool 1 comprises at least one measuring sensor (not illustrated), connected to the control unit U and configured to capture at least one measurement of the transverse dimension of the leading semiproduct P0 and to generate the aforesaid operating data representing the transverse dimension of the leading semiproduct and to send the operating data to the control unit U.

[0106] Preferably, the machine tool 1 may also comprise a user interface device (not illustrated), connected to the control unit U and configured to receive as input at least one measurement of the transverse dimension of the leading semiproduct P0 and to generate the aforesaid operating data representing the transverse dimension of the leading semiproduct and to send the data to the control unit U.

[0107] The operating data are therefore generated cyclically as a function of the transverse dimension T of the leading semiproduct P0 processed.

[0108] Whatever the origin of the operating data, the control unit U is configured to control at least one between the first and the second conveyor 10, 20 by assigning a predetermined stroke to it as a function of the operating data. In the embodiment illustrated in the accompanying drawings, the control unit U is configured to drive the first conveyor 10 for a stroke not greater than the transverse dimension T of the leading semiproduct P0 by moving the leading semiproduct P0 along the loading path R1 so as to position the leading semiproduct P0 in the withdrawal area A1 and, in particular, at least partly on the second supporting surface of the second conveyor 20. Described below is an exemplary, hence non-limiting, preferred embodiment of a method for machining elongated wooden semiproducts, in particular, implemented by the machine tool 1 described in the foregoing. The method for machining elongated, wooden semiproducts is an object of this disclosure.

[0109] In particular, the method is described with reference to an operating cycle of the embodiment of the machine tool 1 described above and illustrated in the accompanying drawings.

[0110] In accordance with this embodiment of the method, the succession S of semiproducts is loaded onto the first conveyor 10. The first conveyor 10 moves the succession S of semiproducts along the loading path R1 until the leading semiproduct P0 abuts against the aforesaid retractile limit stops 12. The retractile limit stops 12

are in the extracted configuration. When the leading semiproduct P0 is in contact with the retractile limit stops 12, the movement of the first conveyor 10 is interrupted.

[0111] After receiving the command to process a new semiproduct inside the machining station 4 of the machine tool 1, the control unit U drives the retractile limit stops 12 so they switch from the extracted configuration to the retracted configuration.

[0112] The first conveyor 10 is then driven by the control unit U for a stroke which is less than or equal to the transverse dimension T of the leading semiproduct P0 so that the leading semiproduct P0 is positioned in the withdrawal area A1. In other words, the first conveyor 10 performs a stroke which is not greater than the width of the leading semiproduct P0 so as to position the leading semiproduct in the withdrawal area A1.

[0113] In particular, in the withdrawal area A1, the leading semiproduct P0 is supported simultaneously by the first supporting surface of the first conveyor 10 and by the second supporting surface of the second conveyor 20. Advantageously, since the leading semiproduct P0 has been made to advance for the length of a stroke that is less than or equal to its transverse dimension T, the two supporting surfaces support only the leading semiproduct P0: the semiproduct directly upstream of the leading semiproduct P0 (along the loading path) is, instead, behind the second conveyor 20 and spaced from it and is therefore supported only by the first supporting surface of the first conveyor 10. During this step, the second conveyor 20 is at the raised position.

[0114] The second conveyor 20 is then activated: the second conveyor 20 withdraws the leading semiproduct P0 from the withdrawal area A1 and moves it along the loading path R1 up to the feed area A2 in proximity to the feed station 3. In the feed area A2, the leading semiproduct P0 comes into abutment against the limit stops 32 of the third conveyor 30 and stops. In particular, in the withdrawal area A2, the leading semiproduct P0 is supported by the second supporting surface of the second conveyor 20 and overlooks the third supporting surface of the third conveyor 30. In other words, the leading semiproduct P0 rests only on the second supporting surface of the second conveyor 20 at a position overlooking the third supporting surface of the third conveyor but not in contact with it. This operating step is illustrated in Figure 3.

[0115] The second conveyor 20 is switched from the raised configuration to the lowered configuration. During this movement, the second supporting surface disengages the leading semiproduct P0, which is now supported only by the third supporting surface of the third conveyor 30. In other words, the second conveyor 20 unloads the leading semiproduct P0 onto the third conveyor 30.

[0116] At this point, the gripping elements of the third conveyor 30 grip the leading semiproduct P0 and move it longitudinally along the feed path R2 from the feed area A2 to the machining station 3.

[0117] The second conveyor 20 is switched from the

lowered configuration to the raised configuration again, ready for the next operating cycle. The leading semiproduct P0 is, instead, machined in the machining station 4 of the machine tool 1.

[0118] In an embodiment not illustrated in the accompanying drawings, the second conveyor 20 comprises a conveyor pad defining the aforesaid second supporting surface and a drive mechanism configured to move the conveyor pad along a closed path passing through the withdrawal area A1 and the feed area A2. In particular, the conveyor pad is configured to be moved cyclically between the withdrawal area A1, where it withdraws the leading semiproduct P0, and the feed area A2, where it unloads the leading semiproduct P0. In other words, the closed path has a first dead centre in proximity to the withdrawal area A1 and a second dead centre in proximity to the feed area A2. Preferably, in this embodiment, the closed path of the conveyor pad extends on at least two levels.

[0119] In particular, the drive mechanism is configured to define a raised configuration of the conveyor pad and a lowered configuration of the conveyor pad.

[0120] The raised configuration of the conveyor pad is suitable for withdrawing and transporting the leading semiproduct P0 along the loading path R1: in this configuration, the second supporting surface is raised with respect to the first supporting surface and the third supporting surface.

[0121] The lowered configuration of the conveyor pad is suitable for unloading the leading semiproduct P0 onto the third supporting surface in the feed area A2: in this configuration, the second supporting surface is lowered with respect to the first supporting surface and the third supporting surface.

[0122] In other words, in this embodiment, the conveyor pad is moved by its drive mechanism along a closed path which extends on at least two levels: in the raised configuration, the conveyor pad is located at a first level, whereas in the lowered configuration, the conveyor pad is located at a second level, lower than the first level.

[0123] Described below is an exemplary, hence non-limiting, preferred embodiment of a method for machining elongated wooden semiproducts, in particular, implemented by the embodiment of the machine tool 1 described above. In particular, the method is described with reference to an operating cycle of the embodiment of the machine tool 1 described above and not illustrated in the accompanying drawings.

[0124] In accordance with this embodiment of the method, the succession S of semiproducts is loaded onto the first conveyor 10. The first conveyor 10 moves the succession S of semiproducts along the loading path R1 until the leading semiproduct P0 abuts against the aforesaid retractile limit stops 12. The retractile limit stops 12 are in the extracted configuration. When the leading semiproduct P0 is in contact with the retractile limit stops 12, the movement of the first conveyor 10 is interrupted.

[0125] After receiving the command to process a new

semiproduct inside the machining station 4 of the machine tool 1, the control unit U drives the retractile limit stops 12 so they switch from the extracted configuration to the retracted configuration.

[0126] The first conveyor 10 is then driven by the control unit U to travel the length of a stroke such that the front of the leading semiproduct P0 (with reference to the loading path) is aligned with a withdrawal position. This withdrawal position is independent of the transverse dimension T of the leading semiproduct P0. In effect, this stroke may be longer than the transverse dimension T of the leading semiproduct P0 itself.

[0127] Once the leading semiproduct P0 is aligned with the withdrawal position, the control unit U drives the second conveyor 20 in the withdrawal area A1. In particular, the second conveyor 20 is driven in such a way that the supporting surface, of the second conveyor 20 at least partly interpenetrates the first supporting surface of the first conveyor 10 (with reference to the loading path) for a stretch not greater than the transverse dimension T of the leading semiproduct P0. During this step, the second conveyor 20 is in the lowered configuration. In other words, the second supporting surface is positioned at a level below the first supporting surface.

[0128] Once in position, the second conveyor 20 is switched from the lowered configuration to the raised configuration. In other words, the second supporting surface is moved to a level above the first supporting surface. During this movement, the second supporting surface engages the leading semiproduct P0 and lifts it off the first supporting surface.

[0129] At this point, the second conveyor 20, via the conveyor pad, moves the leading semiproduct from the withdrawal area A1 to the feed area A2 in proximity to the feed station 3. During this step, the second conveyor 20 is in the raised configuration.

[0130] Once the feed area A2 has been reached, the second supporting surface is at least partly interpenetrated in the third supporting surface of the third conveyor 30 (with reference to the loading path). Furthermore, in the raised configuration, the conveyor pad is positioned at a level above the third supporting surface.

[0131] Once in position, the second conveyor 20 is switched from the raised configuration to the lowered configuration. In other words, the second supporting surface is moved to a level below the first supporting surface. During this movement, the second supporting surface disengages the leading semiproduct P0, which is now positioned on the third supporting surface of the third conveyor 30.

[0132] At this point, the gripping elements of the third conveyor 30 grip the leading semiproduct P0 and move it longitudinally along the feed path R2 from the feed area A2 to the machining station 4 of the machine tool 1.

[0133] The second conveyor 20 is switched from the lowered configuration to the raised configuration again, ready for the next operating cycle. The leading semiproduct P0 is, instead, machined in the machining station 4.

[0134] This invention achieves the preset aims and overcomes the disadvantages of the prior art, set out above: in this regard, it should be noted that the machine tool 1 as described and/or claimed herein allows obtaining an optimum system for feeding the machining station and allows protecting the structural integrity of the machine tool 1 by preventing two or more semiproducts from being moved simultaneously towards the machining station. It should also be noted that the machine tool 1 as described and/or claimed herein allows protecting the structural integrity of the machine tool 1.

[0135] This result is achieved thanks to the structure of the loading station 2 and, in particular, to the structure of the first conveyor 10 and of the second conveyor 20, and thanks to the possibility of precisely driving at least one of the two conveyors 10, 20 as a function of the transverse dimension T of the semiproducts to be processed.

Claims

1. A machine tool (1) for machining elongated, wooden semiproducts, comprising:

- a loading station (2) comprising:

- a first conveyor (10) configured for transversely conveying a succession (S) of juxtaposed semiproducts along a loading path (R1) so as to cyclically position a leading semiproduct (P0) of the succession (S) in a withdrawal area (A1), the first conveyor (10) defining a first supporting surface for the semiproducts;

- a second conveyor (20), located downstream of the first conveyor (10) along the loading path (R1) configured to withdraw the leading semiproduct (P0) from the withdrawal area (A1), separating the leading semiproduct (P0) from the succession (S) of semiproducts and to convey the leading semiproduct (P0) transversely along the loading path (R1) from the withdrawal area (A1) to a feed area (A2), the second conveyor (20) defining a second supporting surface for the semiproducts, configured to be overlaid on the first supporting surface in the withdrawal area (A1);

- a feed station (3) comprising a third conveyor (30), located downstream of the second conveyor (20) along the loading path (R1) and configured to receive and longitudinally convey the leading semiproduct (P0) along a feed path (R2) from the feed area (A2) to a machining station (4) of the machine tool (1); the third conveyor (30) comprising gripping elements configured to grip and move the leading semiproduct (P0) lon-

gitudinally along the feed path (R2);

wherein the machine tool (1) comprises a control unit (U), connected to the conveyors (10, 20, 30) and configured to receive operating data representing a transverse dimension (T) of the leading semiproduct (P0) and to control at least one between the first and the second conveyor (10, 20) by assigning a predetermined stroke to it as a function of the operating data.

2. The machine tool (1) according to claim 1, wherein the first conveyor (10) comprises a conveyor belt (11), preferably a slat belt conveyor or a chain conveyor.
3. The machine tool (1) according to claim 1 or 2, wherein the third conveyor (30) comprises a slide top (31), located downstream of the second conveyor (20) along the loading path (R1) and configured to receive the leading semiproduct (P0) transported by the second conveyor (20); the slide top (31) having a third supporting surface configured to be overlaid, with reference to the loading path (R1), on the second supporting surface of the second conveyor (20) in the feed area (A2) and defining the feed path (R2); the slide top (31) preferably comprising at least one limit stop (32), configured to stop the transverse movement of the leading semiproduct (P0) in the feed area (A2).
4. The machine tool (1) according to any one of the preceding claims, wherein the control unit (U) is configured to drive the first conveyor (10) for a stroke not greater than the width of the leading semiproduct (P0) by moving the leading semiproduct (P0) along the loading path (R1) so as to position the leading semiproduct (P0) in the withdrawal area (A1) and at least partly on the second supporting surface of the second conveyor (20).
5. The machine tool (1) according to any one of the preceding claims, wherein the second conveyor (20) comprises a conveyor belt (21), preferably a slat belt conveyor or a chain conveyor, the second conveyor (20) being preferably parallel to the first conveyor (10).
6. The machine tool (1) according to claim 5, wherein the second conveyor (20) is configured to be switchable between a raised configuration of the conveyor belt (21) suitable for withdrawing and transporting the leading semiproduct (PC), wherein the second supporting surface is coplanar with the first supporting surface and is raised and preferably parallel with respect to the third supporting surface, and a lowered configuration of the conveyor belt (21), suitable for unloading the leading semiproduct (PC) transported

into the feed area (A2), wherein the second supporting surface is lowered at least with respect to the third supporting surface of the third conveyor (30).

7. The machine tool (1) according to claim 5 or 6, wherein the first conveyor (10) and the second conveyor (20) are connected to the same shaft (15) located near the withdrawal area (A1) and wherein the second conveyor (20) is rotatable about an axis of rotation (X) passing through the shaft (15) so that the raised configuration and the lowered configuration are defined by a tilting movement of the second conveyor (20). 5
8. The machine tool (1) according to any one of claims 1 to 4, wherein the second conveyor (20) comprises a conveyor pad defining the second supporting surface and a drive mechanism configured to move the pad along a closed path passing through the withdrawal area (A1) and the feed area (A2); wherein the control unit (U) is configured to define the closed path as a function of the transverse dimension (T) of the leading semiproduct (P0) to be withdrawn so that in the withdrawal area (A1), the second supporting surface interpenetrates the first supporting surface for a stretch not greater than the transverse dimension (T) of the leading semiproduct (P0) to be withdrawn. 10
9. The machine tool (1) according to claim 8, wherein the drive mechanism defines a raised configuration of the conveyor pad suitable for withdrawing and transporting the leading semiproduct (P0) along the loading path (R1), wherein the second supporting surface is raised with respect to the first supporting surface and the third supporting surface, and a lowered configuration of the conveyor pad, suitable for unloading the leading semiproduct (PC) transported into the feed area (A2) onto the third supporting surface, wherein the second supporting surface is lowered with respect to the first supporting surface and the third supporting surface of the slide top (30). 15
10. The machine tool (1) according to any one of the preceding claims, wherein the second conveyor (20) moves at a feed speed greater than the feed speed of the first conveyor (10). 20
11. The machine tool (1) according to any one of the preceding claims, wherein the first conveyor (10) comprises retractile limit stops (12) located on the first supporting surface in proximity to the withdrawal area (A1) and configured to adopt a first, extracted configuration in which they stop the succession (S) of semiproducts moving along the loading path (R1), and a retracted configuration in which they allow the succession (S) of semiproducts to move along the loading path (R1). 25

12. The machine tool (1) according to any one of the preceding claims, comprising at least one of the following: 30

- a measuring sensor, connected to the control unit (U) and configured to capture at least one measurement of the transverse dimension (T) of the leading semiproduct (P0) and to generate the operating data representing the transverse dimension (T) of the leading semiproduct (P0);
- a user interface device, connected to the control unit (U) and configured to receive as input at least one measurement of the transverse dimension (T) of the leading semiproduct (P0) and to generate the operating data representing the transverse dimension (T) of the leading semiproduct (P0). 35

13. A method for machining elongated, wooden semiproducts, in particular implemented by a machine tool (1) according to any one of the preceding claims, comprising the following steps: 40

- conveying a succession (S) of juxtaposed semiproducts transversely along a loading path (R1) via a first conveyor (10) so as to cyclically position a leading semiproduct (P0) of the succession (S) in a withdrawal area (A1);
- withdrawing the leading semiproduct (P0) from the withdrawal area (A1) via the second conveyor (20) to separate the leading semiproduct (P0) from the succession (S) of semiproducts and conveying the leading semiproduct (P0) via the second conveyor (20) transversely along the loading path (R1) from the withdrawal area (A1) to a feed area (A2);
- conveying the leading semiproduct (P0) longitudinally via a third conveyor (30) along a feed path (R2) from the feed area (A2) to a machining station (4); 45

characterized in that at least one between the first conveyor (10) and the second conveyor (20) performs a predetermined stroke as a function of the operating data representing a transverse dimension (T) of the leading semiproduct (P0). 50

14. The method according to claim 13, wherein the first conveyor (10) is driven in such a way as move the leading semiproduct (P0) along the loading path (R1) for a stroke not greater than the transverse dimension (T) of the leading semiproduct (P0) so as to position the leading semiproduct (P0) in the withdrawal area (A1). 55
15. The method according to claim 13 or 14, wherein the second conveyor (20) comprises a conveyor pad movable cyclically along a closed path passing

through the withdrawal area (A1) and the feed area (A2); the conveyor pad, in the withdrawal area, being configured to at least partly interpenetrate the first conveyor (10) for a stretch not greater than the transverse dimension (T) of the leading semiproduct (P0). 5

16. The method according to any one of claims 13 to 15, wherein the second conveyor (20) is cyclically switched between a raised configuration and a lowered configuration. 10

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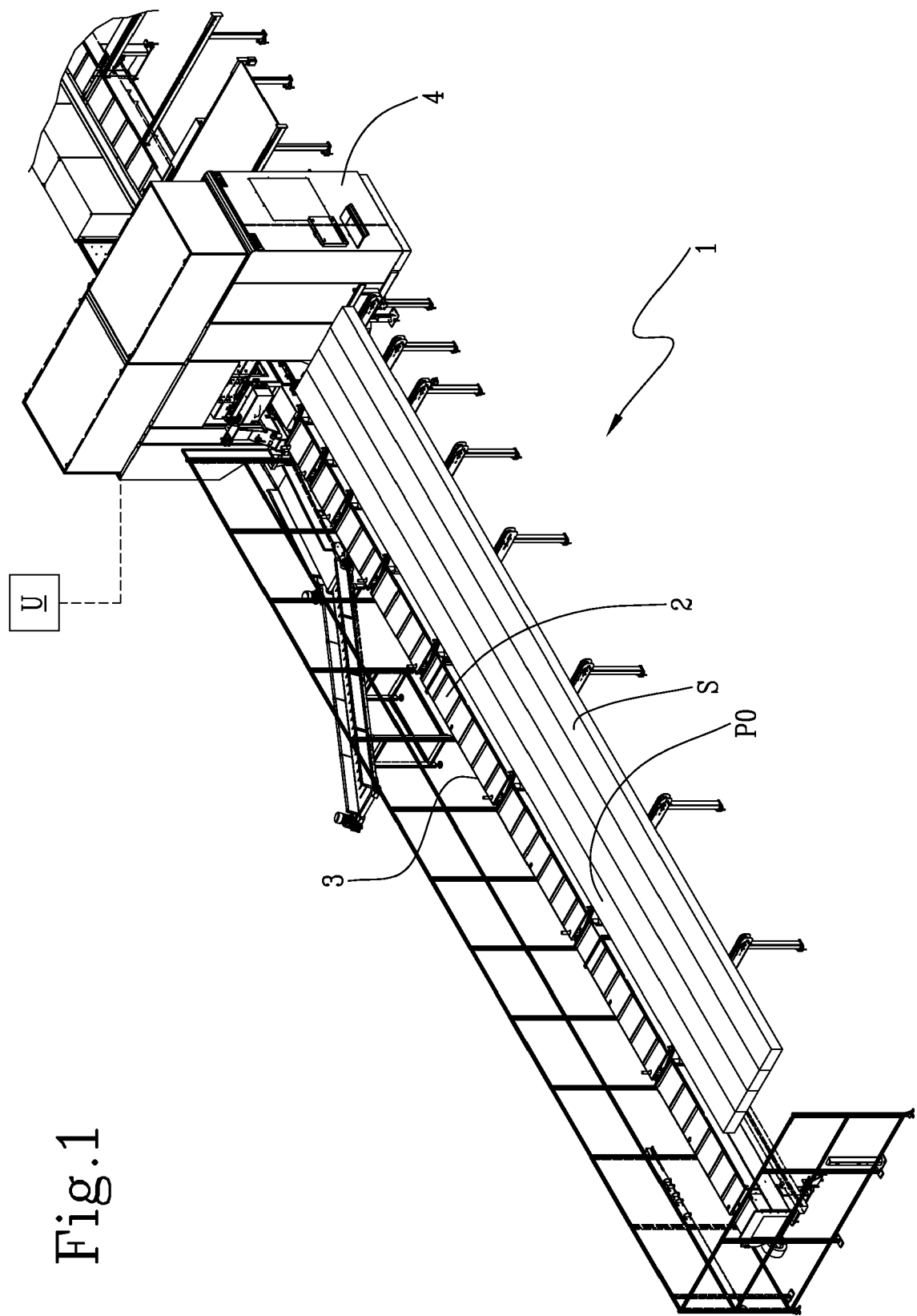


Fig. 1

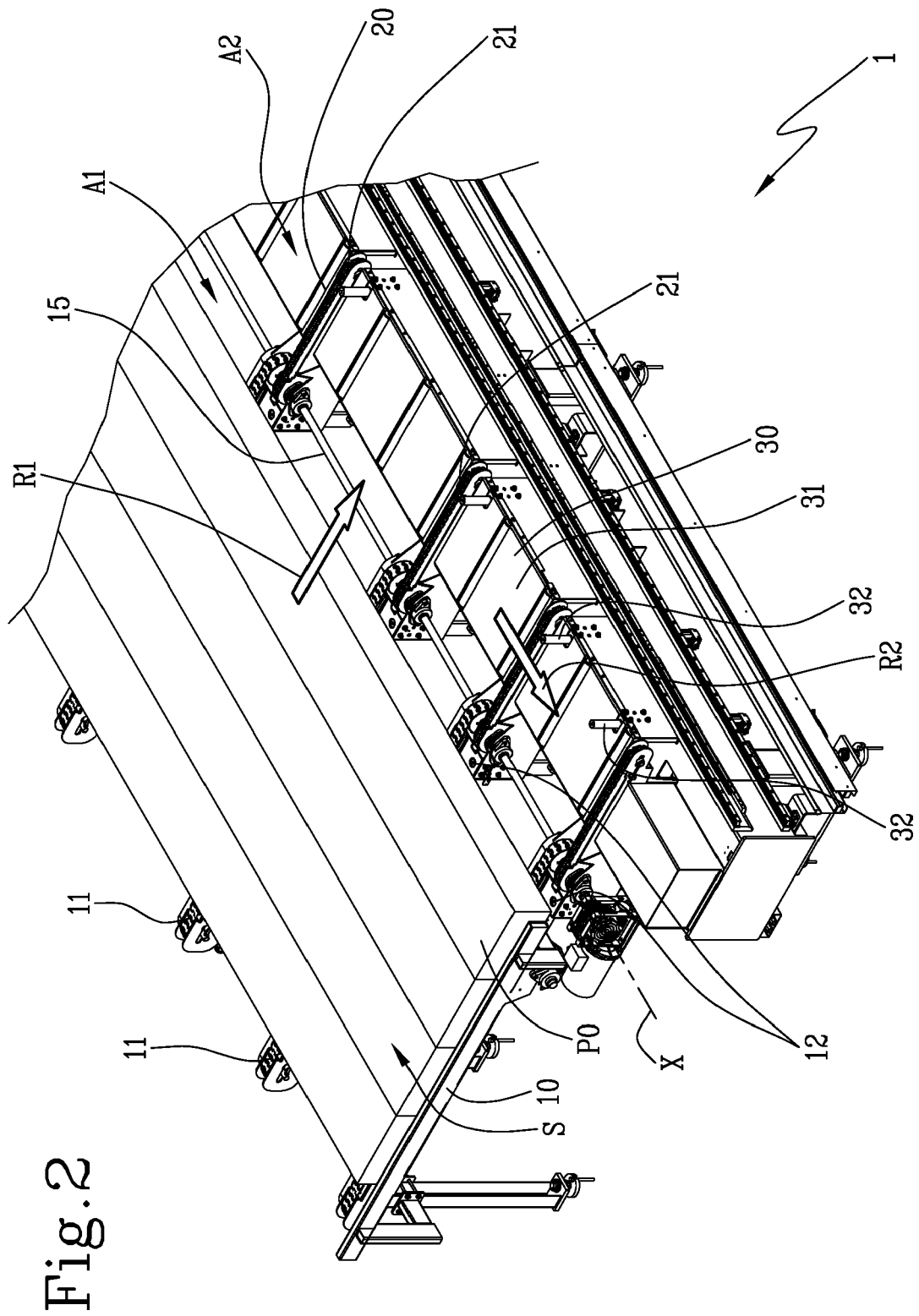


Fig. 2

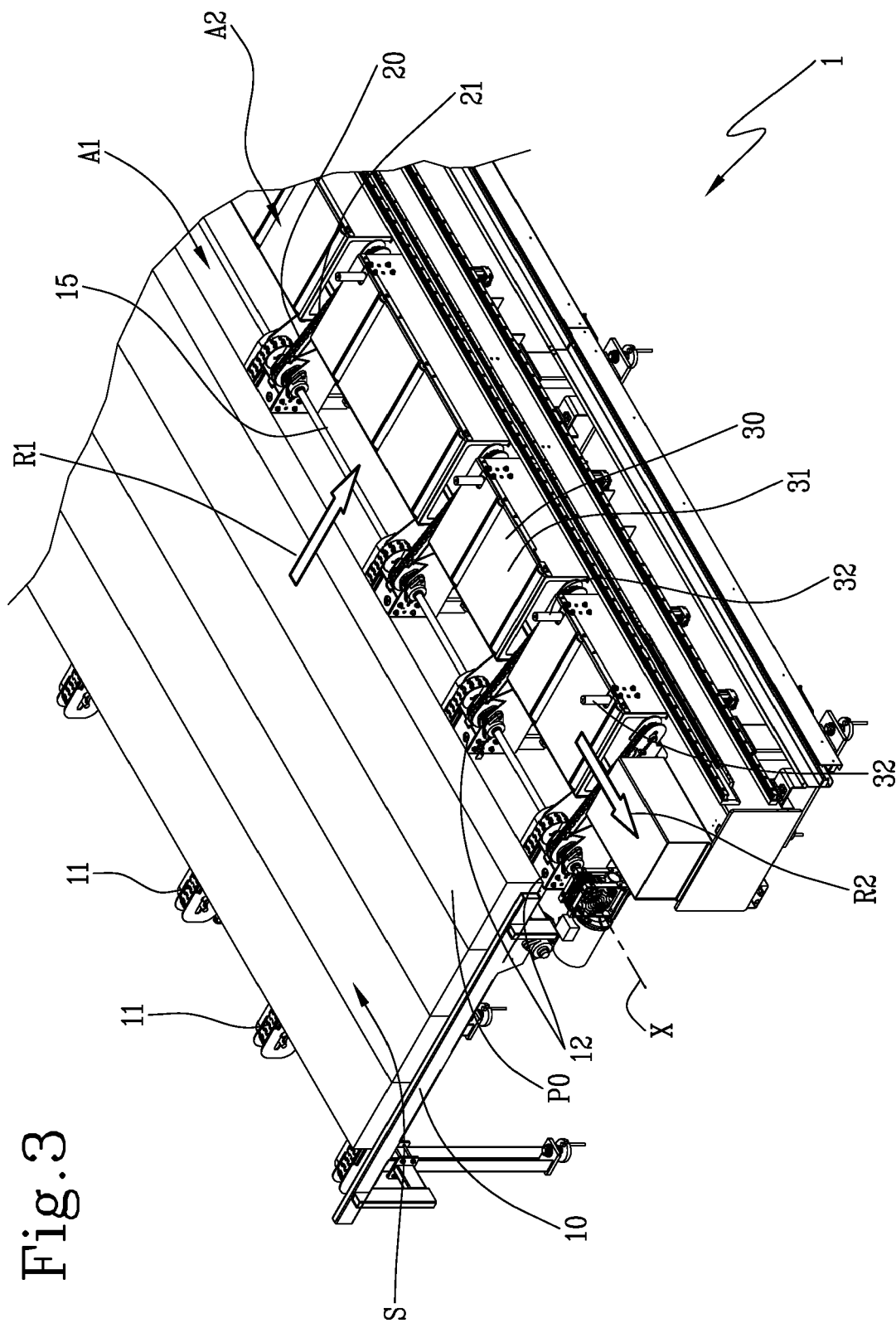


Fig. 3

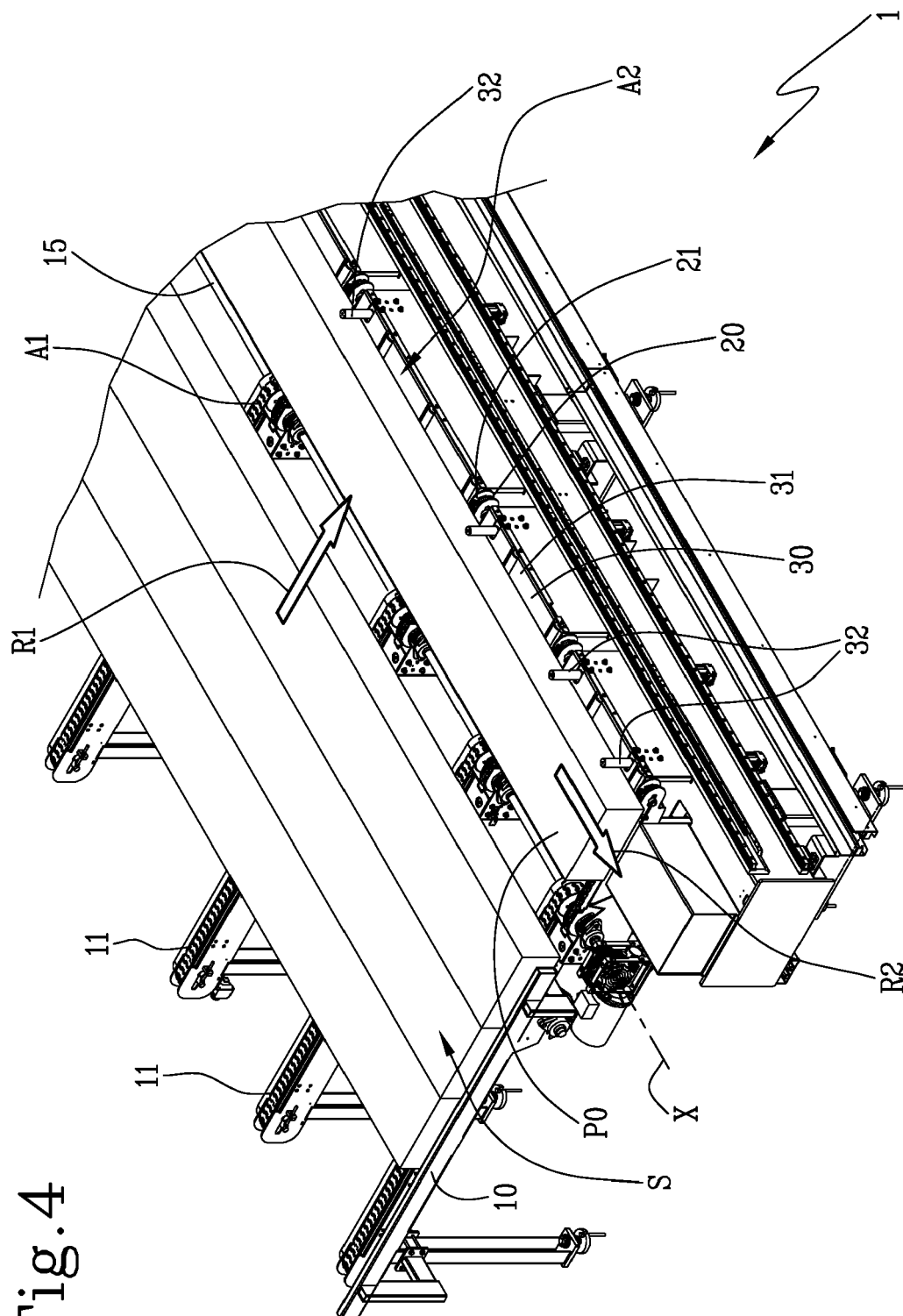


Fig. 4



EUROPEAN SEARCH REPORT

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 September 2024	Examiner Hamel, Pascal
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