(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 597 578 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.01.2020 Bulletin 2020/04

(51) Int Cl.:
B65H 3/24 *(2006.01)* ***B65H 1/06*** *(2006.01)*
B65H 5/06 *(2006.01)*

(21) Application number: **19187346.2**

(22) Date of filing: **19.07.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **19.07.2018 IT 201800007352**

(71) Applicant: **FATIGROUP S.R.L.**
35010 Villafranca Padovana (PD) (IT)

(72) Inventor: **SEGALINA, Luca**
35134 Padova (IT)

(74) Representative: **Morabito, Sara et al**
Cantaluppi & Partners S.r.l.
Piazzetta Cappellato Pedrocchi, 18
35122 Padova (IT)

(54) SUPPLY SYSTEM FOR ELONGATE ELEMENTS FOR SUPPLYING ELONGATE ELEMENTS TO A WORKING MACHINE

(57) A supply system (1) for supplying elongate elements (100, 100', 100") in an advance direction (F) comprises a containment device (20) for containing a plurality of elongate elements (100, 100', 100") which are stacked one on the other so as to form a pile (10) of elongate elements (100, 100', 100"), the elongate elements (100, 100', 100") being planar elements with a prevalent longitudinal extent along a longitudinal axis (Z1), 100"), a conveying device (40) for conveying the elongate elements (100, 100', 100") to an operating machine (200), the conveying device (40) being provided with a movement device (45) which is capable of moving the elongate elements (100, 100', 100") in the advance direction (F), an extraction device (30) for extracting the elongate elements (100, 100', 100") from the containment device (20) and for moving them towards the conveying device (40), wherein the extraction device (30) comprises at least one extraction element (31, 31A) which is formed to engage with the lower elongate element (100') which is positioned in a lower position in the pile (10) and to extract it from the pile (10) by moving it in an extraction direction (F1) which is located substantially perpendicularly to the advance direction (F) towards the conveying device (40), wherein each extraction element (31A) comprises an engagement tooth (35) which is provided on the face of the extraction element (31A) which is directed towards the lower elongate element (100') and which is intended to engage with the lower elongate element (100') in order to extract it from the pile (10).

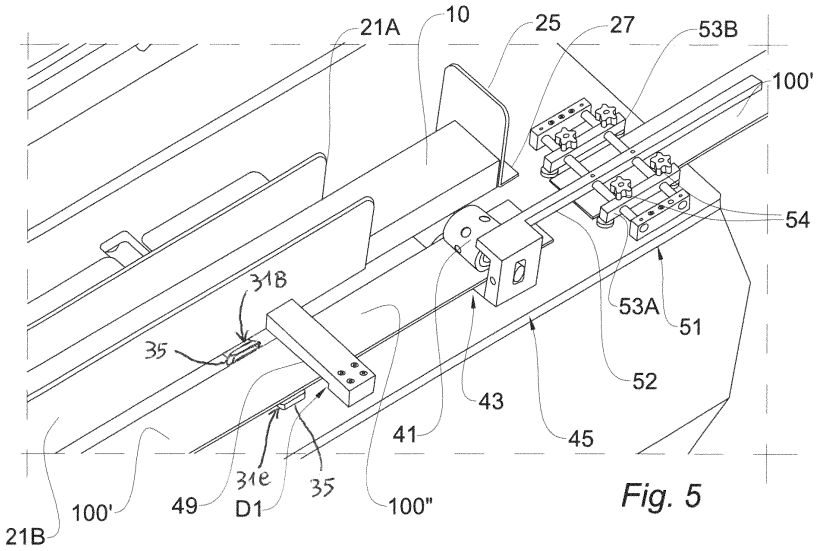

Fig. 5

EP 3 597 578 A1

Description

[0001] The invention relates to a supply system for supplying elongate elements. In particular, the supply system of the invention allows storage of a desired number of elongate elements which are stacked one on the other and automatic supply thereof one at a time to an operating machine which is positioned downstream of the supply device of the invention.

[0002] The term "elongate element" is intended to be understood in the context of the present description to be a planar element having a very small thickness and having an extent in the longitudinal direction which is considerably greater than the individual extent in the transverse direction.

[0003] Such elongate elements can be produced from flexible material and are, in this case, generally referred to as strips or can be produced from rigid material and are, in this case, usually referred to in the sector in question as bands or straps. The elongate elements are usually stacked so as to form a pile having a desired number of elongate elements and, by means of an extraction device, are successively extracted from this pile and supplied to an operating machine, such as, for example, a punch or a press which shapes and cuts them in order to obtain an object having the desired form.

[0004] The elongate elements have to be supplied to the operating machine at a speed and frequency corresponding to the work cycle of the operating machine itself. This machine, as a result of individual characteristics of the working operations which it carries out, draws back the elongate elements at a variable speed. Conversely, the extraction devices are usually configured to work at a constant speed.

[0005] A problem of the known devices is that of coordinating the operation of the extraction device and conveying the elongate elements and the operation of the operating machine, preventing, on the one hand, too many elongate elements from being conveyed to the operating machine and, on the other hand, the operating machine from having to be stopped to wait for a new elongate element. In the first case, the elongate elements would tend to become bent and deformed while, in the second case, there would be undesirable breaks of the operating machine and, therefore, slow-downs of production.

[0006] In both cases, the intervention of an operator would be required in order to stop the extraction device or the operating machine, respectively.

[0007] There are known, for example, from WO2017148216 apparatuses for automatically supplying strip-like material to an operating machine in which an adjustment system for the advance of the strips is provided.

[0008] However, WO2017148216 does not address the problem of coordination of the operation of the supply apparatus with an automatic conveying device of the material strips.

[0009] Furthermore, the extraction of the elongate elements from the pile of elongate elements presents substantial problems.

[0010] In fact, the extraction has to be carried out in a precise manner avoiding undesirable occurrences of dragging of the elongate element or the elongate elements which is/are positioned in contact with the elongate element to be extracted.

[0011] An object of the invention is to provide a system for supplying elongate elements to an operating machine which allows the limitations indicated above with reference to the cited prior art to be overcome.

[0012] This object is achieved by means of a supply system which is constructed according to the independent claim 1.

[0013] Preferred features of the invention are defined in the dependent claims.

[0014] The features and advantages of the invention will be better appreciated from the following detailed description of some preferred embodiments thereof which are illustrated, by way of non-limiting example, with reference to the appended drawings, in which:

- Figure 1 is a perspective view of a system according to the invention in an operating configuration;
- Figures 2, 3 and 6 are views as in Figure 1 but in relation to different operating configurations of the system of the invention;
- Figures 4 and 5 are enlarged, interrupted views of the system of Figure 1 in additional operating configurations;
- Figure 7 is a side view of a detail of the system of the invention;
- Figure 8 is a bottom view of a detail of the system of the invention;
- Figure 9 is an enlarged perspective view of a detail of the system of the invention;
- Figures 10 and 11 are a front view and a perspective, schematic view of an elongate element to be supplied with the system of the invention, respectively. The appended Figures show a supply system according to the invention which is generally designated 1 and which is intended to supply elongate elements in an advance direction which is indicated by the arrow F in Figure 1.

[0015] An elongate element 100 which can better be seen in Figures 10 and 11 is a planar element having a very small thickness "d" which is delimited by a pair of longitudinal walls A, A' which extend along a longitudinal axis Z1 of the elongate element 100 and a pair of transverse walls B, B' which extend along a transverse axis X1 of the elongate element 100 which is perpendicular to the longitudinal axis Z.

[0016] The length L of the elongate element 100, that is to say, the extent of the longitudinal walls A, A', is considerably greater than the width L1 of the elongate element 100 itself, that is to say, the extent of the transverse

walls B, B'.

[0017] In accordance with the final use, the elongate element may be constructed from a suitable desired material.

[0018] Advantageously, the elongate element is produced from metal.

[0019] In a particularly preferred form, the elongate element is produced from aramid fibre, advantageously without asbestos.

[0020] In the supply system 1 of the invention, a desired number of elongate elements 100 are positioned one on the other so as to form a pile 10 of elongate elements 100 having a desired number of elongate elements which are positioned one on the other, as can be seen, for example, in Figure 9.

[0021] There can be formed piles which have a desired number of elongate elements depending on the dimensions, weight, etc., thereof.

[0022] The supply system 1 comprises a support body 2 having a support base 3 and a work plane 4 which can be closed with a covering element 5 and on which the elongate elements 100 are positioned and moved.

[0023] In a Cartesian reference system XYZ, the work plane 4 is positioned in a transverse plane XZ which is defined by a longitudinal axis Z and a transverse axis X.

[0024] In the version shown, the advance direction F is substantially parallel with the longitudinal axis Z of the work plane 4 and the extraction direction F1 is substantially parallel with the transverse axis X of the work plane 4, as will be better explained below.

[0025] The pile 10 of elongate elements 100 is positioned in such a manner that the longitudinal axis Z1 of the elongate elements 100 is arranged parallel with the advance direction F and the transverse axis X1 of the elongate elements 100 is arranged parallel with the extraction direction F1.

[0026] In the version shown, the covering element 5 comprises a first cover 5A and a second cover 5B which are beside each other in the advance direction F and which are intended to be moved independently of each other in order to open and close the work plane 4.

[0027] The first cover 5A and the second cover 5B are provided with a respective handle 6A, 6B in order to make opening/closing by an operator easier.

[0028] The support base 3 is internally hollow and intended to receive instruction and control devices of the supply system 1, which are not shown in the Figures.

[0029] The first cover 5A is normally kept closed during the operation of the system 1, is usually opened for carrying out adjustment operations, for example, to adapt the system to supply elongate elements having different dimensions, or for maintenance operations.

[0030] There may further be provided a stopping device which stops the operation for the system 1 if the first cover 5A is open.

[0031] The supply system 1 further comprises an operating interface 7 which is positioned near the work plane 4 so as to be accessible by an operator in order to control and adjust the operation of the supply system 1. The operating interface 7 is provided with a plurality of buttons 70 or other control elements which are operatively connected to the instruction and control devices of the supply system in order to control and adjust the supply system 1, in a manner known in the field.

[0032] The work plane 4 comprises at least one cavity 4A which is intended to cooperate with an extraction device 30 of the supply system 1 in order to extract the elongate elements 100 from the pile 10 of elongate elements 100, as will be better explained below.

[0033] In the version shown, the work plane 4 comprises a plurality of cavities 4A which are shown in greater detail in Figure 9 and which are spaced apart in the advance direction F and which are intended to cooperate with an extraction device 30 of the supply system 1 in order to extract the elongate elements 100 from the pile 10 of elongate elements 100, as will be better explained below. The supply system 1 comprises a containment device 20 which is positioned on the work plane 4 and which is intended to contain a pile 10 of elongate elements 100 which is inserted into the containment device 20 by an operator, as will be better explained below.

[0034] The containment device 20 comprises a first and a second lateral containment wall 21A, 21B which project from the work plane 4 and which extend in a vertical direction Y, perpendicularly thereto. The first and the second lateral containment walls 21A, 21B extend in the advance direction F and are mutually spaced apart in the direction of the transverse axis X of the work plane 4 in such a manner that the pile 10 of elongate elements 100 can be received between them. Advantageously, at least one of the first and second lateral containment walls 21A, 21B can be moved along the transverse axis X in order to vary the transverse dimensions of the containment device 20 in order to receive elongate elements 100 having mutually different transverse dimensions.

[0035] The first and the second lateral containment walls 21A, 21B are intended to interact with the opposite longitudinal walls A, A' of the elongate elements 10.

[0036] The first and the second lateral containment walls 21A, 21B are positioned in such a manner that the second lateral containment wall 21B is interposed between the first lateral containment wall 21A and a conveying device 40 of the supply system 1 of the invention, as will be better explained below.

[0037] The first lateral containment wall 21A is fixed by means of a bracket 22A to the work plane 4. The bracket 22A is provided with an adjustment element 23A which can be seen in Figure 9 and which is intended to adjust the position of the first containment wall 21A on the work plane 4 in the transverse direction X relative to the advance direction F.

[0038] In this manner, by acting on the adjustment element 23A, it is possible to vary the distance between the lateral containment walls 21A, 21B and to contain, with the containment device 20, elongate elements having mutually different widths L1.

[0039] The second lateral containment wall 21B is fixed to the work plane 4 in an adjustable manner.

[0040] The second lateral containment wall 21B is positioned on the work plane 4 in such a manner that a gap 26, which can better be seen in Figure 7, is defined between the second lateral containment wall 21B. The gap 26 is capable of allowing the passage of the elongate elements 100 between the second lateral containment wall 21B and the work plane 4, as will be better explained below. The gap 26 advantageously has a dimension D2 which is greater than the thickness "d" of the elongate elements 100 to be supplied and less than double the thickness "d" of the elongate elements, as explained by the following relationship: d<D2<2*d.

[0041] This allows at the same time the elongate elements to be readily passed into the gap 26 so that they can be extracted from the pile 10 and moved towards the conveying device 40, as will be better explained below, and prevention of undesirable dragging of the elongate elements which are adjacent to the elongate element to be extracted from the pile 10, as will be better explained below. In this manner, one elongate element at a time is extracted from the pile 10.

[0042] Adjustment elements are provided to adjust the position of the second lateral containment wall 21B along the vertical axis Y with respect to the work plane 4, that is to say, the dimensions of the gap 26.

[0043] The supply system 1 further comprises an accompanying device which is intended to receive the elongate elements 100 from an extraction device 30 and to cooperate with the conveying device 40 in order to convey the elongate elements 100, as will be better explained below.

[0044] In the version shown, the accompanying device comprises a plurality of support brackets 46 which are spaced apart from each other along the longitudinal axis Z. The second lateral containment wall 21B is fixed at a plurality of support brackets 46 to the work plane 4.

[0045] Each support bracket 46 comprises a body which is L-shaped with a base 48 which is fixed to the work plane 4 and which projects therefrom in a vertical direction Y and an arm 49 which extends from the base 48 parallel with the work plane 4 in a transverse direction X as far as the second lateral containment wall 21B which is positioned so as to define with the work plane 4 a sliding cavity 49A for the elongate elements 100.

[0046] The base 48 is formed in such a manner that the arm 49 is arranged at a distance "D1" from the work plane 4 which is greater than or equal to the thickness "d" of the elongate element 100.

[0047] In this manner, the elongate element 100 can be inserted and can slide between the work plane 4 and the arm 49, as will be better explained below.

[0048] The brackets 46 are advantageously adjustable in a vertical direction Y with respect to the work plane 4 in order to vary the dimension D1 of the sliding cavity 49A.

[0049] There are provided adjustment means which are not visible in the Figures for adjusting the position of the base 48 of each support bracket 46 along the vertical axis Y in order to consequently adjust the dimension of the distance D1, and of the gap 26 and to adapt the supply system 1 to elongate elements 100 having mutually different thicknesses.

[0050] There may be provided additional adjustment means, not shown in the Figures, in order to adjust the position of the base 48 of each support bracket 46 along the transverse axis X of the work plane 4 in order to consequently adjust the distance between the first and the second lateral containment walls 21A, 21B and to adapt the supply system 1 to elongate elements 100 having mutually different widths L1.

[0051] The containment device 20 further comprises a front wall 25 which projects perpendicularly from the work plane 4 in a vertical direction Y and which is intended to interact with a transverse wall B, B' of the elongate elements 100. The front wall 25 extends in a transverse direction X1 and is fixed by means of an additional bracket 27 to the work plane 4.

[0052] The front wall 25 may be provided with a front adjustment element which cannot be seen in the Figures in order to move the front wall 25 in the advance direction F on the work plane 4 in order to contain with the containment device 20 elongate elements 100 having mutually different lengths L.

[0053] As a result of it being possible to vary the position of at least one of the lateral containment walls 21A, 21B and one of the front walls 25, it is possible to receive in the containment device 20 elongate elements 100 having mutually different dimensions.

[0054] The front wall 25 is intended to act as an abutment wall during insertion of a pile 10 of elongate elements 100 in the supply system 1, as will be better explained below.

[0055] Advantageously, the elongate elements 100 are positioned in the containment device 20 in such a manner that the longitudinal axis Z thereof is parallel with the advance direction F.

[0056] The supply system 1 further comprises an extraction device 30 in order to extract the elongate elements 100 from the containment device 20 and to move them towards a conveying device 40.

[0057] The conveying device 40 receives the elongate elements 100 from the extraction device 30 and conveys them towards an operating machine 200 which is only partially visible in Figure 7, as will be better explained below.

[0058] The extraction device 30 is configured so as to move the longitudinal elements 100 in an extraction direction which is indicated with the arrow F1 in Figure 9 and which is positioned substantially perpendicularly to the advance direction F, that is to say, parallel with the transverse axis X of the work plane 4.

[0059] The extraction device 30 comprises at least one extraction element 31 which is movable along the transverse axis X of the work plane 4 in both the directions of the extraction direction, as indicated by the arrow F1,

between an extraction configuration W, which is visible in Figure 9 and in which the extraction device 30 is positioned in the region of the pile 10 of elongate elements 100 and can take the elongate element 100' which is positioned in a lower position in the pile 10, and a release configuration W', which is visible in Figures 2 and 5 and in which the extraction device 30 is positioned externally relative to the pile 10 and the extracted elongate element 100' is positioned in the region of the conveying device 40, as will be better explained below.

[0060] Advantageously, in the release configuration W', the elongate elements 100 are positioned in the region of the accompanying device, that is to say, inserted in the sliding cavity 49A.

[0061] The at least one extraction element 31 of the extraction device 30 is formed to engage with the lower elongate element 100', that is to say, the elongate element 100' which is positioned in a lower position in the pile 10, that is to say, supported on the work plane 4, and to extract it from the pile 10 by moving it in the extraction direction F1 towards the conveying device 40.

[0062] In the version shown, the extraction device 30 comprises a plurality of extraction elements 31 which are spaced apart in the advance direction F and which are intended to engage with the lower elongate element 100' in mutually spaced-apart positions along the longitudinal axis Z1 thereof.

[0063] Each extraction element 31A of the plurality of extraction elements 31 is formed so as to be connected with positive-locking connection to a cavity 4A which is provided in the work plane 4 in order to be able to interact with the lower elongate element 100' of the pile 10.

[0064] Each extraction element 31A is slidable in a corresponding cavity 4A which is provided in the work plane 4 during the movement between the extraction configuration W and the release configuration W'.

[0065] This allows the positioning of the elongate elements 100 to be made more stable on the work plane 4 and, at the same time, the extraction of the lower elongate element 100' by means of the plurality of extraction elements 31 to be made more precise.

[0066] In fact, the work plane 4 provides a stable support for the elongate elements 100 which is not impaired by the presence of the cavities 4A and at the same time the extraction elements 31A can freely move in the cavities 4A without risking dragging a plurality of elongate elements.

[0067] Each extraction element 31 of the plurality of extraction elements 31 comprises an engagement tooth 35 which is provided on the face of the extraction element 31A which is directed towards the lower elongate element 100' and which is intended to engage with the lower elongate element 100' in order to extract it from the pile 10, as will be better explained below.

[0068] The engagement tooth 35 projects from the face of the extraction element 31A which is directed towards the lower elongate element 100' so as to engage with the lower elongate element 100' and to move it, during the movement of the extraction device 30, in the extraction direction F1 towards the conveying device 40.

[0069] Advantageously, the engagement tooth is intended to engage with the lower elongate element 100' in the region of one of the longitudinal walls A, A' thereof. The engagement tooth 35 has such dimensions as to project in the vertical direction Y with respect to the work plane 4 in order to be able to engage with the lower elongate element 100'.

[0070] In one version, the face of the extraction element 31A which is directed towards the lower elongate element 100' is arranged substantially at the same level as the work plane 4, but in other versions it may be slightly projecting with respect to the work plane towards the lower elongate element 100'.

[0071] The presence of the engagement tooth 35 allows a more effective grip on the lower elongate element 100'.

[0072] Furthermore, the presence of the engagement tooth 35 prevents the lower elongate element 100' from losing adhesion with respect to the extraction element 31A, for example, if a particularly high extraction speed is required. Furthermore, the engagement with one of the longitudinal walls A, A' of the lower elongate element 100' allows further stabilization of the positioning of the lower elongate element 100 and a reduction of undesirable movements thereof. The engagement teeth 35 of each extraction element 31A are provided in a mutually corresponding position in the transverse direction X so as to keep the elongate element 100 correctly aligned.

[0073] The term "correctly aligned" is intended to be understood to mean the positioning in which the longitudinal axis Z1 of the elongate element 100 is parallel with the advance direction F.

[0074] Each extraction element 31A comprises an engagement tooth 35 which is positioned in the region of an edge 31B of the extraction element 31A which is provided in a distal position with respect to the lower elongate element 100', that is to say, distal with respect to the first lateral containment wall 21A.

[0075] Each extraction element 31A defines an extraction seat for the lower elongate element 100'.

[0076] In the version shown, each extraction element 31A comprises a pair of engagement teeth 35 which are arranged in the region of opposite edges 31B, 31C of the extraction element 31A so as to define a C-shaped extraction element 31A.

[0077] This configuration allows the engagement of the lower elongate element 100' to be made particularly precise, avoiding undesirable occurrences of dragging of other elongate elements and/or undesirable movements of the lower elongate element 100'.

[0078] Furthermore, the C-shaped formation allows the lower elongate element 100' to be received in a stable manner inside each extraction element 31A.

[0079] In this version, in fact, each extraction element 31A defines a receiving seat for the lower elongate element 100'.

[0080] An advantage of this configuration is that of further increasing the stability of the grip of the extraction element 31A on the lower elongate element 100.

[0081] Another advantage, if there are provided two conveying devices 40 which are positioned at the opposite sides with respect to the containment device 20, is that of being able to move the lower elongate element 100' in two different directions so as to supply the different conveying devices 40 as required.

[0082] In this case, both the lateral containment walls 21A, 21B are spaced apart in the containment device 20 with respect to the work plane 4 in order to allow the passage of an elongate element 100.

[0083] The extraction device 30 further comprises a connection element 32, which can be seen in Figure 8, for mutually connecting the extraction elements 31A of the plurality of extraction elements 31 in order to fixedly join them to each other. The extraction device 30 further comprises a drive motor 33 which is intended to move the plurality of extraction elements 31 in both directions of the extraction direction F1.

[0084] The drive motor 33 is connected to the connection element 32 in order to move all the extraction elements 31 simultaneously.

[0085] The drive motor 33 is provided with a speed variator 33A in order to be able to vary the actuation speed of the motor 33 itself.

[0086] The drive motor 33 is operatively connected to the interface 7 in order to be adjusted by an operator.

[0087] The supply system 1 further comprises a conveying device 40 which is intended to receive the elongate elements 100 from the extraction device 30 and to convey them to an operating machine 200 which is only partially visible in Figure 7.

[0088] The operating machine 200 is intended to carry out predetermined operations on the elongate elements 100, depending on the product to be produced. The operating machine 200 attracts the elongate elements 100 at a speed dependent on the type of processing to be carried out.

[0089] The removal device 80 removes the elongate element 100 from the conveying device 40 at a speed which depends on the operating cycle of the operating machine 200 and moves it towards the operating machine 200 at this speed, which is also variable over time.

[0090] As will be better explained below, the conveying device 40 comprises an automatic adjustment device 75 which is intended to automatically vary the conveying speed of the elongate elements 100 with the conveying device 40 on the basis of the speed at which the elongate element 100 is removed by the removal device 80.

[0091] The conveying device 40 comprises a movement device 45 which is capable of moving the elongate element 100 in the advance direction F from the extraction device 30 towards the removal device 80 of the operating machine 200.

[0092] The movement device 45 comprises a drive roller 42 which can rotate about an individual rotation axis and which is intended to engage with the elongate element 100 and to convey it in the advance direction F.

[0093] The movement device 45 further comprises an idle roller 41 which is positioned in a position facing the drive roller 42 so that there is defined therebetween a through-hole 43 for the elongate element 100 and which is intended to cooperate with the drive roller 42 in order to convey the elongate element 100.

[0094] The elongate element 100 is gripped between the external surfaces of the drive roller and the idle roller and conveyed by means of the rotation thereof in the advance direction F.

[0095] The movement device 45 is further provided with an adjustment system 70 in order to adjust the position of the idle roller 41 with respect to the drive roller 42, as will be better explained below.

[0096] The idle roller 41 is engaged in a sliding manner with a support 71 which is fixed in turn to the work plane 4 and which is provided with a slot 72, in which the pin 41A of the idle roller 41 can slide in the direction of the vertical axis Y in both directions of the arrow F3 in Figure 7.

[0097] The automatic adjustment system 70 comprises a spring which cannot be seen in the Figures and which is preloaded so as to urge the idle roller 41 towards the drive roller 42.

[0098] The spring is preloaded in order to urge the idle roller 41 so that there is defined between the idle roller 41 and the drive roller 42 a through-hole 43 which has a size less than the thickness "d" of the elongate elements 100 being conveyed. When an elongate element 100 is inserted in the through-hole 43, the idle roller 41 is urged away from the drive roller 42 counter to the action of the spring, and the pin 41A thereof slides in the slot 72.

[0099] If, during the conveying of the elongate element 10, resistance is encountered, for example, because the elongate element 100 being conveyed with the conveying device 40 is urged into abutment against the elongate element moved by the removal device 80, there is generated a resistant force counter to the urging force generated by the drive roller 42. When the resistant force is greater than the urging force, the drive roller continues to rotate but the idle roller 41 slides on the elongate element 100 and the conveying is in fact interrupted.

[0100] The idle roller 41 no longer engages with the elongate element 100, the element is no longer gripped between the drive roller 42 and the idle roller 41 and, even if the drive roller 42 continues to rotate, this does not bring about movement of the elongate element in the advance direction.

[0101] Therefore, obstructions of the operating machine or damage to the elongate elements are prevented in an immediate and simple manner.

[0102] There are provided adjustment elements which are associated with at least one of the drive roller 42 and the idle roller 41 in order to adjust the mutual spacing thereof and, therefore, the dimensions D3 of the hole 43 which is defined therebetween and, therefore, to adapt

the conveying system 40 to elongate elements 100 having mutually different thicknesses "d". The movement device 45 further comprises a motor 44 which is operatively connected to the drive roller 42 in order to actuate it and to a speed variator, which is not visible in the Figures, so that it is possible to vary the speed of rotation of the drive roller 42 and therefore the conveying speed of the elongate element 100.

[0103] Advantageously, the external surface of the drive roller 42 is provided with knurling or other elements in order to increase the grip on the elongate elements 100. In a version, the drive roller 42 can be produced from rubber or other material with a high friction coefficient in order to increase the grip on the elongate elements 100 being conveyed.

[0104] The conveying device 40 further comprises at least one guide device 51 in order to guide the movement of the elongate elements 100 in the advance direction F.

[0105] The guide device 51 is positioned downstream in the advance direction F with respect to the movement device 45 and is arranged in order to maintain the elongate element 100 in a desired conveying trajectory. This prevents the elongate element 100 from being able to have undesirable movements during the conveying and, therefore, from being unable to be correctly removed by the removal device 80.

[0106] The guide device 51 comprises a pair of guide bars 53A, 53B which are positioned in mutually facing positions, between which the elongate element 100 being conveyed is intended to pass.

[0107] The guide bars 53A, 53B are positioned parallel with the advance direction F and allow centring and guiding of the elongate elements.

[0108] The guide device 51 is provided with an adjustment device 54 in order to adjust the mutual spacing between the guide bars 53A, 53B so as to be able to adapt the conveying device 40 to convey elongate elements having mutually different widths L1.

[0109] The guide device 51 further comprises a pressure element 52 in order to keep the elongate element 100 close to the work plane 4 and to prevent the formation of folds, wrinkles or raised portions of the pressure element 100 from the work plane 4.

[0110] The pressure element comprises, in the form shown, a bar 52 which extends in the advance direction F and which is intended to press the elongate element 100 on the work plane 4.

[0111] There are further provided adjustment devices in order to adjust the spacing of the bar 52 from the work plane 4 in order to convey elongate elements 100 having mutually different thicknesses "d".

[0112] The bar 52 is positioned in such a manner that the elongate element 100 slides between the work plane 4 and the bar 52.

[0113] Advantageously, the position of the bar 52 is adjusted in such a manner that there is contact between the elongate element 100 and the bar 52 itself in order to prevent the formation of wrinkles and folds.

[0114] The conveying device 40 further comprises a detection device 60 which is intended to detect the presence of an elongate element 100 in the conveying device 40 in order to adjust the operation of the conveying device 40 and/or the extraction device 30.

[0115] The detection device 60 comprise a plurality of optical sensors 61 which are capable of detecting the presence of the elongate element 100.

[0116] Advantageously, the optical sensors 61 are positioned near the drive roller 42 and/or the idle roller 41.

[0117] Preferably, the optical sensors 61 are positioned downstream of the idle roller 41 in order to detect the presence/absence of an elongate element 100 downstream of the idle roller 41, as will be better explained below.

[0118] The detection device 60 is associated with the conveying device 40 in order to detect the position of the elongate element 100 in the conveying device 40 in order to consequently actuate or stop the extraction device 30 in order to extract an additional elongate element 100 from the pile.

[0119] When the optical sensors 61 detect the absence of an elongate element 100 in the detection zone, the extraction device 30 is actuated in order to extract an additional elongate element 100 from the pile 10.

[0120] Conversely, the actuation of the extraction device 30 is interrupted as long as the optical sensors 61 detect the presence of an elongate element 100 in the detection zone.

[0121] During operation, an operator loads a pile 10 of elongate elements 100 in the containment device 20, urging the elongate elements 100 in abutment against the front wall 25.

[0122] Subsequently, the operator closes the cover 5 and actuates the supply system 1 by acting on the interface 7.

[0123] There is actuated the extraction device 30 which moves extraction configuration W' in the direction of extraction F1 towards the conveying device 40.

[0124] In this manner, the engagement tooth 35 is moved towards the lower elongate element 100', engaging it and dragging it with movement in the direction of extraction F1.

[0125] The lower elongate element 100' is received in the seat which is defined by the extraction elements 31A of the extraction device 30.

[0126] Therefore, the elongate element 100' which is positioned at the bottom in the pile 10 of elongate elements 100 is drawn, by extracting it from the pile 10 by moving it in the extraction direction F1.

[0127] The extraction direction F1 is perpendicular to the advance direction F. Advantageously, the elongate elements 100 are positioned in such a manner that the longitudinal axis Z1 thereof is parallel with the advance direction F. Therefore, they are moved by means of the extraction device 30 in the individual transverse direction X1.

[0128] This substantially simplifies the extraction op-

erations.

[0129] This further reduces any phenomena of dragging of the elongate element which is positioned above the lower elongate element 100'.

[0130] This advantage is maintained independently of the orientation of the elongate elements 100 with respect to the advance direction F, both when they are positioned with the longitudinal axis Z1 parallel with the advance direction F, as in the case described above, and also when they are arranged with the individual transverse axis X1 parallel with the advance direction F.

[0131] By moving the extraction device 30, the lower elongate element 100' is progressively extracted from the pile 10 and moves into the gap 26 until it is moved outside the pile 10.

[0132] The extraction device 30 moves the lower elongate element 100' by inserting it in the sliding cavity 49A.

[0133] The extraction device 30 moves the lower elongate element 100' by inserting it progressively inside the sliding cavity 49A of the brackets 46 and the through-hole 43 which is defined between the idle roller 42 and the drive roller 41 so that the lower elongate element 100' can be subsequently moved with the conveying device 40.

[0134] Furthermore, the provision of the accompanying device and in particular the provision of the sliding cavities 49A in the region of each bracket 46 allows guidance of the movement of the lower elongate element 100'. In particular, for example, in the case of flexible material, such as, for example, materials for producing seals, there is prevented the formation of wrinkles or undulations in the lower elongate element 100' in the advance direction F.

[0135] When the elongate element 100' is external with respect to the pile 10, it can be moved in the advance direction F without interfering with the other elongate elements 100 which are present in the pile 10.

[0136] The extraction device 30 is moved as far as the release configuration W' in which the elongate element 100' is outside the pile 10 and is positioned in the region of the conveying device 40 and inserted in the sliding cavity 49A and/or the through-hole 43 between the idle roller 42 and the drive roller 41.

[0137] In this manner, the elongate element 100 can be moved by actuating the movement device 45.

[0138] In a version, in the delivery configuration W' of the extraction device 30, the elongate element 100 is moved into abutment against the support 71 to which the idle roller 41 is fixed.

[0139] The support 71 acts as an abutment for the elongate element 100.

[0140] In this manner, there is obtained alignment of the elongate element 100' with the conveying device 40.

[0141] Subsequently, the extraction device 30 is moved until it returns to the extraction position W'.

[0142] Simultaneously, the drive roller 41 is actuated and the elongate element 100' is conveyed by the conveying device 40 in the advance direction F.

[0143] The elongate element 100' is caused to pass between the guide bars 53A, 53B. In this manner, there are obtained alignment and a correct positioning of the elongate element 100' being conveyed.

[0144] The bar 52 further maintains the elongate element 100' in a state correctly positioned on the work plane 4.

[0145] The elongate element 100' is conveyed by the conveying device 40 towards the removal device 80.

[0146] When the elongate element 100' reaches the removal device 80, it is dragged thereby at a speed which depends on the speed at which the elongate element 100' is required by the operating machine 200.

[0147] When the elongate element 100' reaches the removal device 80, the motor 44 is stopped, and therefore the drive roller 42, and the elongate element 100 is no longer conveyed by the conveying device 40 but is instead moved by means of the removal device 80.

[0148] There are provided position sensors which are not shown in the Figures and which are advantageously of the mechanical type and intended to detect when the elongate element 100' is supplied to the removal device 80 in order to consequently stop the motor 44.

[0149] When the optical sensors 61 of the detection device 60 detect the absence of an elongate element 100' in the detection zone 63, they transmit a signal which allows repeated actuation of the extraction device 30 in order to extract an additional elongate element 100" from the pile 10.

[0150] The optical sensors 61 are positioned downstream of the movement device 45 so that, when they detect the absence of an elongate element 100 in the detection zone 63, the elongate element 100' which is conveyed has already been removed by the removal device 80 and is moved by means of the removal device 80 towards the operating machine 200.

[0151] The optical sensors 61 are positioned downstream of the movement device 45 so that, when they detect the absence of an elongate element 100, there is no elongate element inserted in the through-hole 43 between the idle roller 41 and the drive roller 42, that is to say, the movement device 45 is free to receive an additional elongate element 100".

[0152] In other words, the conveying device 40 is free to receive an additional elongate element 100" from the extraction device 30.

[0153] The additional elongate element 100" is extracted in the same manners seen above and inserted in the through-hole 43 between the idle roller 42 and the drive roller 41 in order to be moved by means of the conveying device 40. The additional elongate element 100" is conveyed in the advance direction F.

[0154] Since the elongate element 100' and the additional elongate element 100" are moved by the removal device 80 and the conveying device 40, respectively, they are moved at mutually different speeds and the mutual spacing may vary.

[0155] The conveying device 40 moves the additional

elongate element 100" until it is moved into abutment with the elongate element 100', that is to say, so as to move the respective facing transverse walls B, B' of the additional elongate element 100" and the elongate element 100' into contact with each other.

[0156] If there are stoppages or slow-downs of the removal device 80 and the additional elongate element 100" urges against the elongate element 100, the movement device 45 is stopped and the conveying of the additional elongate element 100" is stopped.

[0157] The movement device 45 encounters a conveying resistance greater than the urging force generated by the movement device 45 and this device generates a lifting of the idle roller with respect to the additional elongate element 100". Therefore, it is no longer gripped between the idle roller 41 and the drive roller 42 and is not conveyed in the advance direction F.

[0158] The possibility of varying the conveying speed of the conveying device 40 prevents the occurrence of jams between two consecutive elongate elements 100, 100".

[0159] In the system of the invention, the elongate elements are supplied with a head/tail supply.

[0160] The supply system 1 further comprises a sensor which is associated with the containment device 20 which, when it detects that there is a limited number of elongate elements 100 in the containment device 20, sends a corresponding signal.

[0161] There is generated a warning signal and an operator provides for charging a new pile of elongate elements in the containment device.

[0162] The charging operation can be carried out without stopping the supply system and before the elongate elements in the containment device are finished because these operations are carried out without interfering with the operation of the supply system which is carried out in the lower portion of the pile, while the new pile is superimposed on the preceding one.

[0163] Therefore, undesirable pauses of the supply system are prevented.

[0164] When it is desirable to insert additional elongate elements in the system of the invention, the operator provides for opening the second cover 5B in order to uncover a portion of the work plane 4 which is positioned upstream in the advance direction F and to charge in the containment device 20 a pile 10 of elongate elements 100, as can be seen in Figure 6.

[0165] The pile 10 is supported on the elongate elements 100 which are already present in the containment device 20.

[0166] The pile 10 is positioned by urging the elongate elements 100 into abutment against the front wall 24.

[0167] Subsequently, the operator closes the second cover 5B.

[0168] As mentioned, this operation is carried out without any need to stop the operation of the system of the invention.

[0169] Therefore, the system achieves the predetermined objectives by allows the production of a number of advantages with respect to the known supply systems.

Claims

1. Supply system (1) for elongate elements (100, 100', 100") for supplying elongate elements (100, 100', 100") in an advance direction (F) comprising:

   - a containment device (20) for containing a plurality of elongate elements (100, 100', 100") which are stacked one on the other so as to form a pile (10) of elongate elements (100, 100', 100"),
   - said elongate elements (100, 100', 100") being planar elements with a prevalent longitudinal extent along a longitudinal axis (Z1) of said elongate elements (100, 100', 100"),
   - a conveying device (40) for conveying said elongate elements (100, 100', 100") to an operating machine (200), said conveying device (40) being provided with a movement device (45) which is capable of moving said elongate elements (100, 100', 100") along said advance direction (F),
   - an extraction device (30) for extracting said elongate elements (100, 100', 100") from said containment device (20) and for moving said elongate elements (100, 100', 100") towards said conveying device (40),
   - said extraction device (30) comprising at least one extraction element (31, 31A) which is formed to engage with the lower elongate element (100') which is positioned in a lower position in said pile (10) and to extract it from said pile (10) by moving it in an extraction direction (F1) which is located substantially perpendicularly to said advance direction (F) towards the conveying device (40), the system being **characterized in that** said at least one extraction element (31A) comprises an engagement tooth (35) which is provided on the face of the extraction element (31A) which is directed towards the lower elongate element (100') and which projects from said face in order to engage with said lower elongate element (100') in order to extract it from said pile (10).

2. Supply system according to the preceding claim, wherein said engagement tooth (35) is provided in the region of an edge (31B) of said extraction element (31A) which is distal with respect to said lower elongate element (100').

3. Supply system according to claim 1 or claim 2, wherein said at least one extraction element (31A) comprises a pair of engagement teeth (35) which are

arranged in the region of opposite edges of said extraction element (31A) so as to define a C-shaped extraction element (31A).

4. Supply system according to any one of the preceding claims, wherein said elongate elements (100, 100', 100") are positioned in said containment device in such a manner that said longitudinal axis (Z1) is parallel with said advance direction (F), said elongate elements (100, 100', 100") being moved in the transverse direction thereof by said extraction device (30).

5. Supply system according to any one of the preceding claims, wherein said extraction device (30) comprises a plurality of extraction elements (31, 31A) which are spaced apart in the advance direction (F) and which are intended to engage with said elongate elements (100, 100', 100") in engagement positions which are spaced apart in the longitudinal direction (Z1) of said elongate elements (100, 100', 100").

6. Supply system according to the preceding claim, wherein the engagement teeth (35) of each extraction element (31A) are provided in mutually corresponding positions in the transverse direction X so as to move the elongate element (100, 100', 100") in a correctly aligned state.

7. Supply system according to any one of the preceding claims, wherein said extraction device (30) comprises a drive motor (33) which is intended to move said plurality of extraction elements (31) in both the directions of the extraction direction (F1) and a connection element (32) for mutually connecting the extraction elements (31A) of the plurality of extraction elements (31) in order to fixedly join them to each other in terms of movement.

8. Supply system according to any one of claims 1 to 6, wherein said conveying device (40) comprises a movement device (45) in order to move said elongate elements (100, 100', 100") in said advance direction and at least one guide element (51, 53A, 53B) in order to guide the movement of said elongate elements (100, 100', 100") in said advance direction (F).

9. Supply system according to claim 7, wherein said conveying device (40) comprises a pressure element (52) which is positioned downstream in said advance direction (F) with respect to the movement device (45) and which is provided in order to keep said elongate element (100', 100") close to said work plane (4).

10. Supply system according to any one of the preceding claims and comprising a detection device (60) which is associated with said conveying device (40) and which is intended to detect the position of said elongate element (100', 100") in said conveying device (40) in order to consequently actuate said extraction device (30) in order to extract an additional elongate element (100") from said pile (10).

11. Supply system according to any one of claims 7 to 9, and comprising an adjustment device for controlling the conveying speed of the conveying device (40) on the basis of the speed at which the elongate element (100') is drawn back by the operating machine (200).

12. Supply system according to any one of claims 7 to 10, wherein said movement device (45) comprises a drive roller (42) which is rotatable about the rotation axis thereof and an idle roller (41) which is positioned in a position facing said drive roller (42) so that there is defined therebetween a through-hole (43) for said elongate element (100) and which is intended to cooperate with said drive roller (42) in order to convey said elongate element (100), said idle roller (41) preferably being movable with respect to said drive roller (42) in order to vary the extent of said through-hole (43).

13. Supply system according to any one of the preceding claims and further comprising an accompanying device (46, 48, 49) which is intended to receive said elongate elements (100) from said extraction device (30) and to cooperate with said conveying device (40) in order to convey said elongate elements (100).

14. Supply system according to the preceding claim, wherein said accompanying device (46, 48, 49) comprises at least one support bracket (46) having a body which is L-shaped with a base (48) which is fixed to said work plane (4) and which projects from said work plane (4) in a vertical direction (Y) and an arm (49) which extends from said base (48) substantially parallel with said work plane (4) in a transverse direction (X) and which defines with said work plane (4) a sliding cavity (49A) for said elongate elements (100).

15. Supply system according to the preceding claim, wherein said accompanying device (46, 48, 49) comprises a plurality of support brackets (46) which are spaced apart from each other along said longitudinal axis (Z), said brackets preferably being adjustable in a vertical direction (Y) in order to vary the dimension of said sliding cavity (49A).

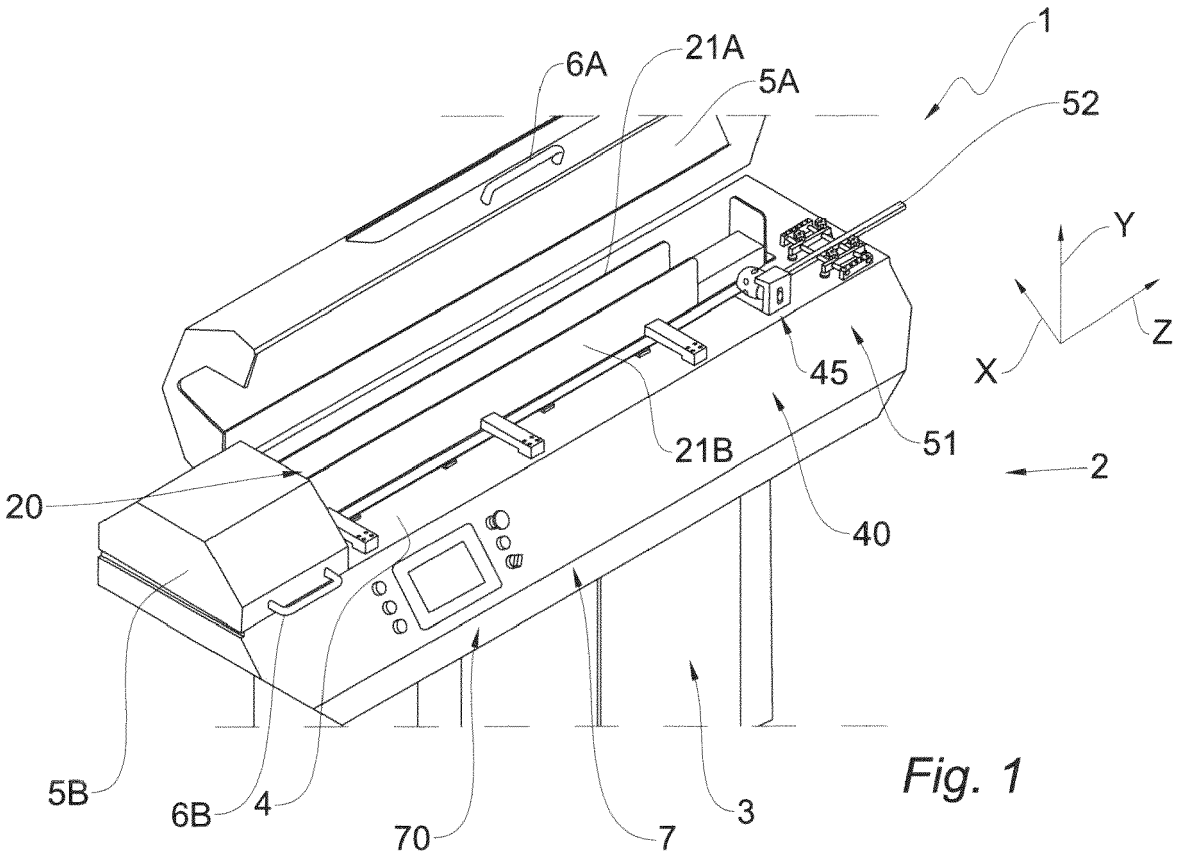
1
6A
21A
5A
52
Y
Z
X
45
51
21B
2
20
40
5B
6B
4
70
7
3

Fig. 1

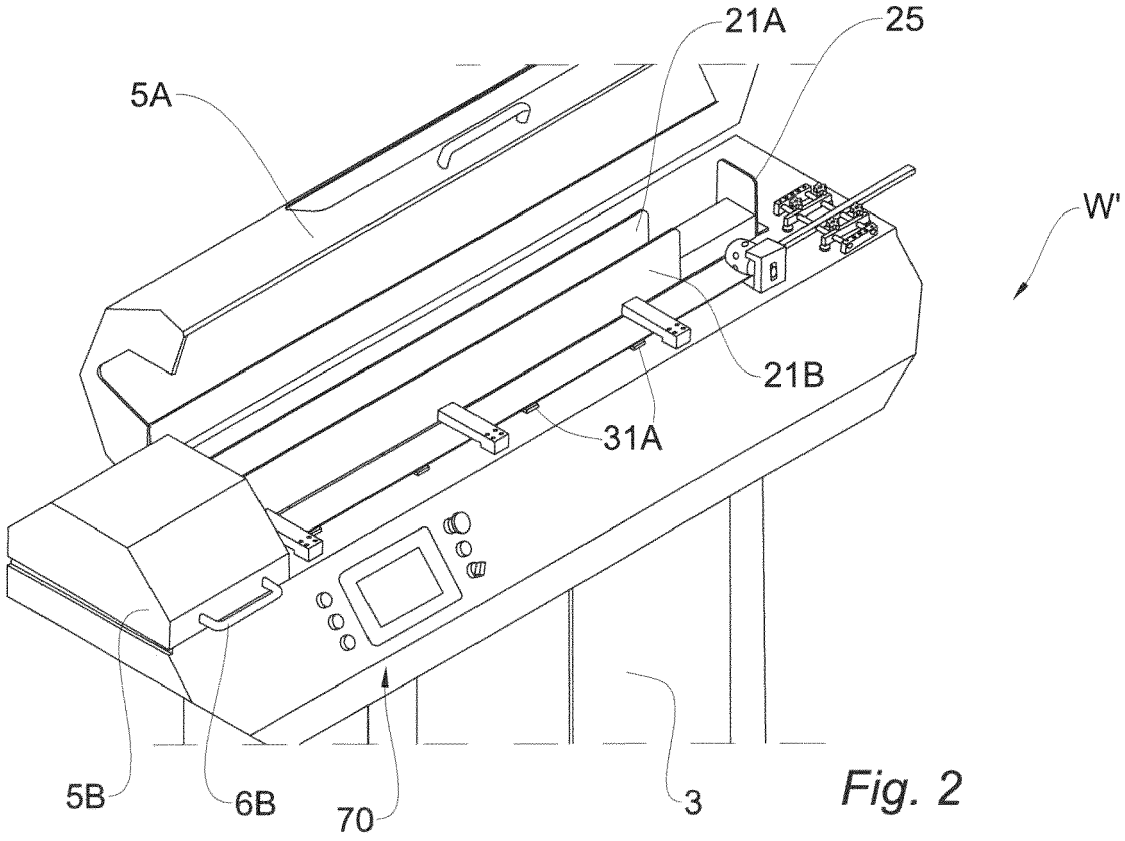
21A
25
5A
W'
21B
31A
5B
6B
70
3

Fig. 2

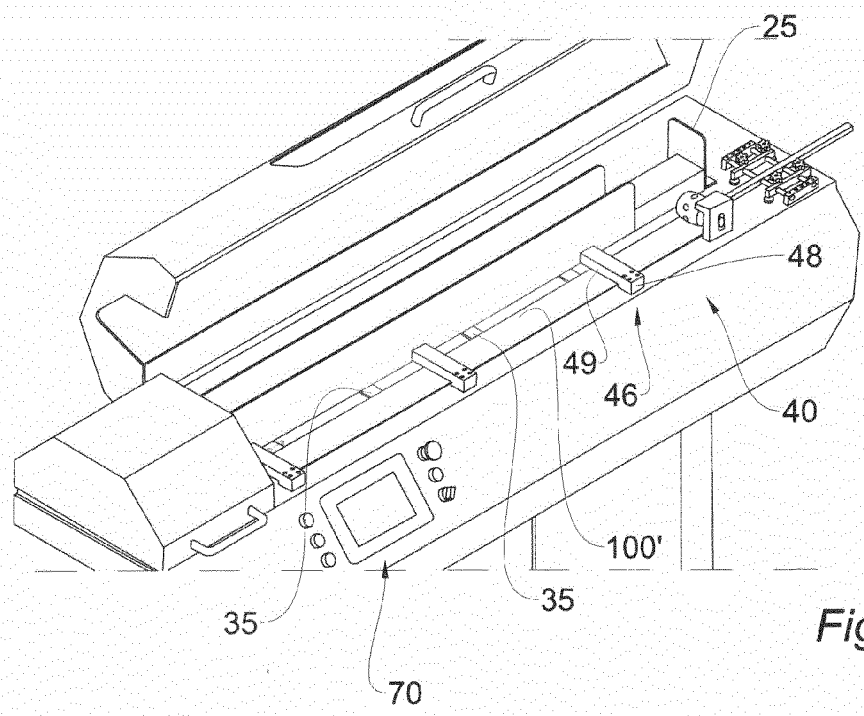
25
48
49
46
40
100'
35
35
70

Fig. 3

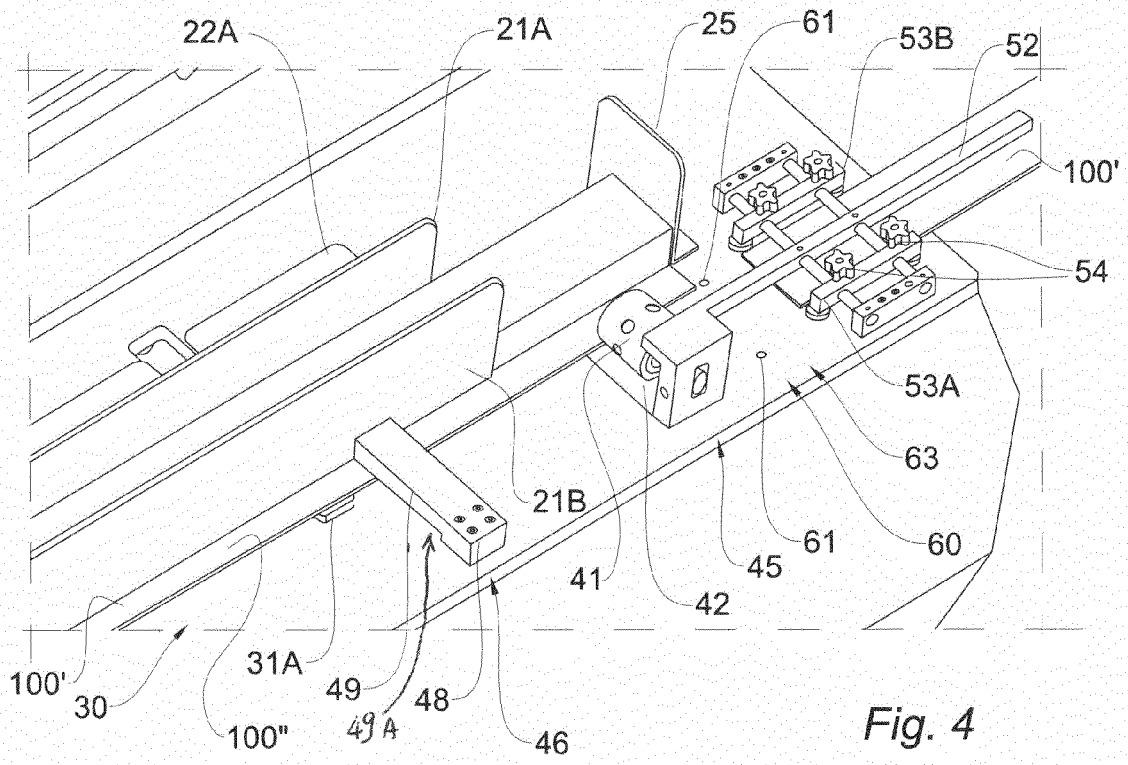
22A
21A
25
61
53B
52
100'
54
53A
63
21B
61
60
45
41
42
100'
30
31A
49
48
49A
100"
46

Fig. 4

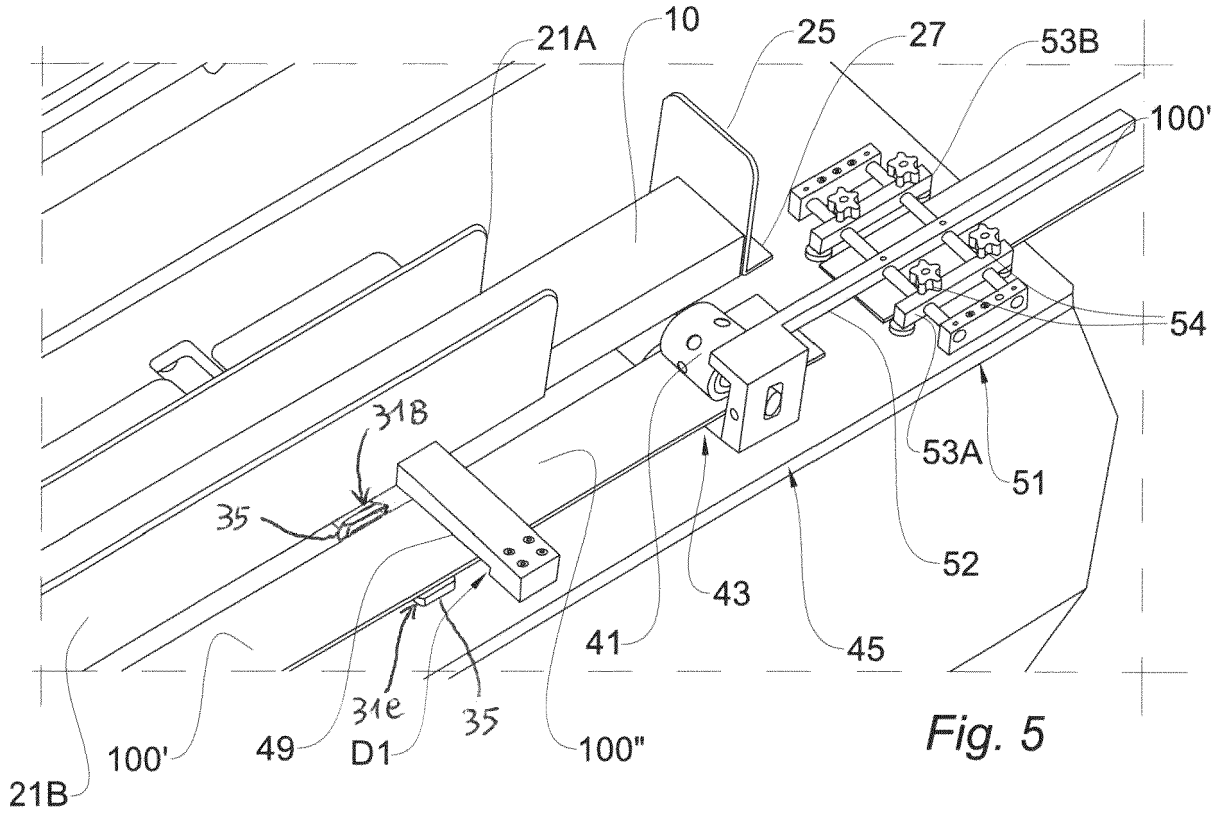
21A
10
25
27
53B
100'
54
31B
35
53A
51
52
43
41
45
21B
100'
49
31e
D1
35
100"

Fig. 5

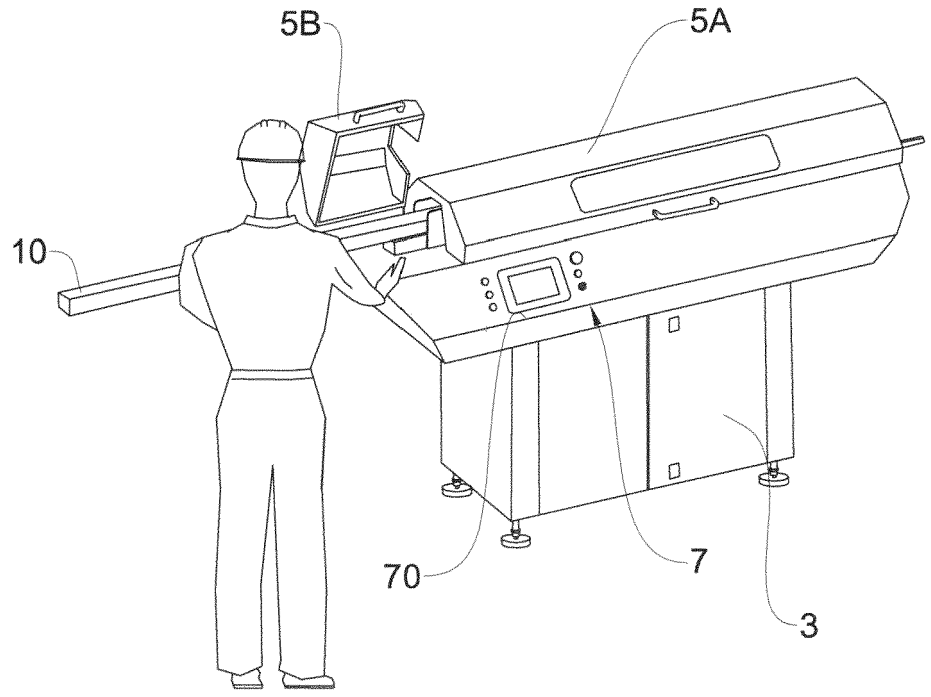
5B
5A
10
70
7
3

Fig. 6

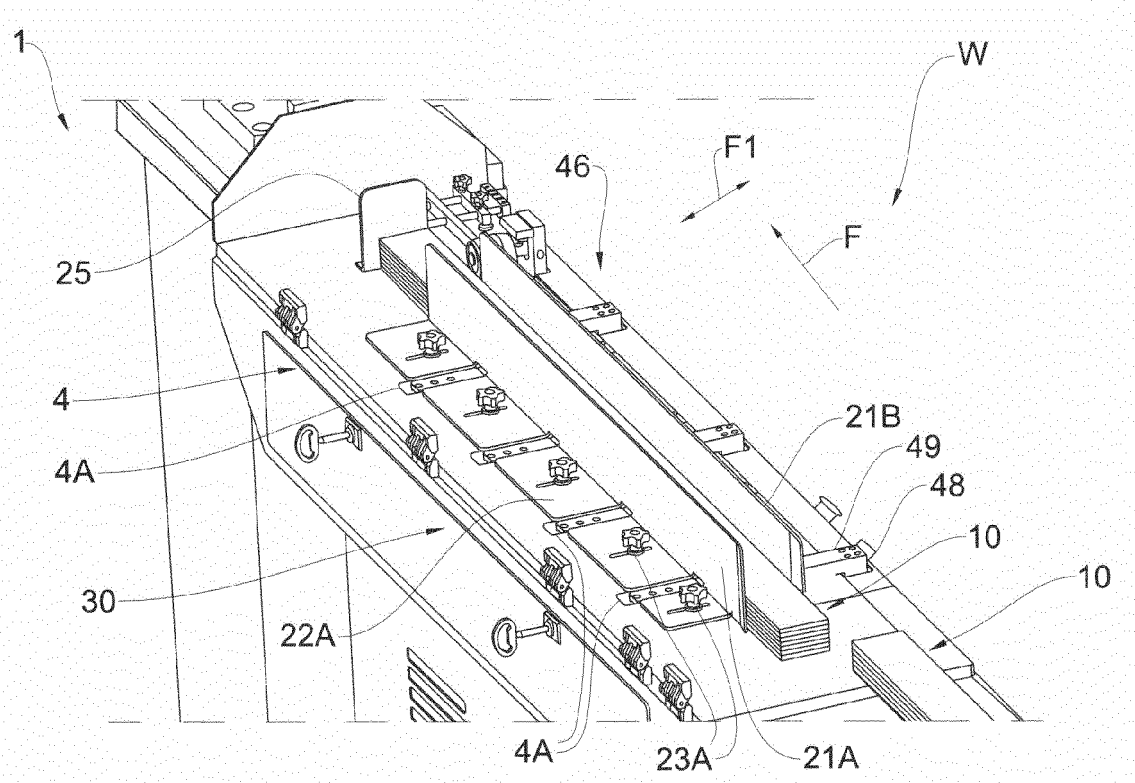

Fig. 9

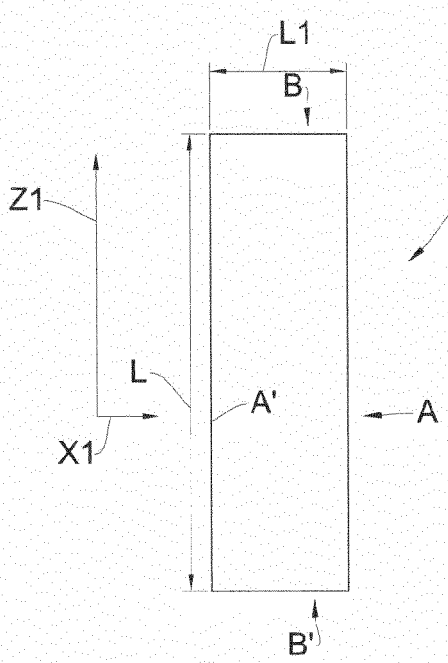

Fig. 10

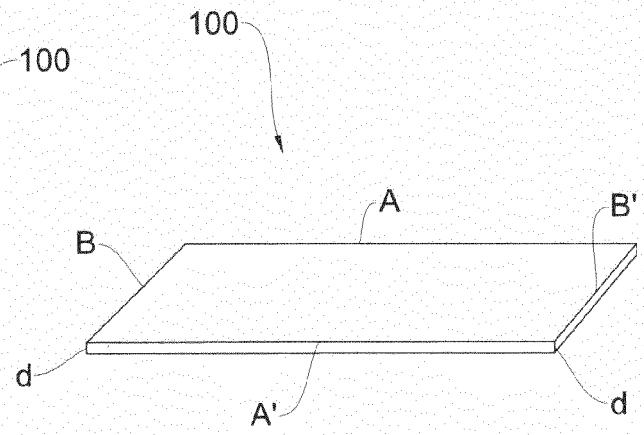

Fig. 11

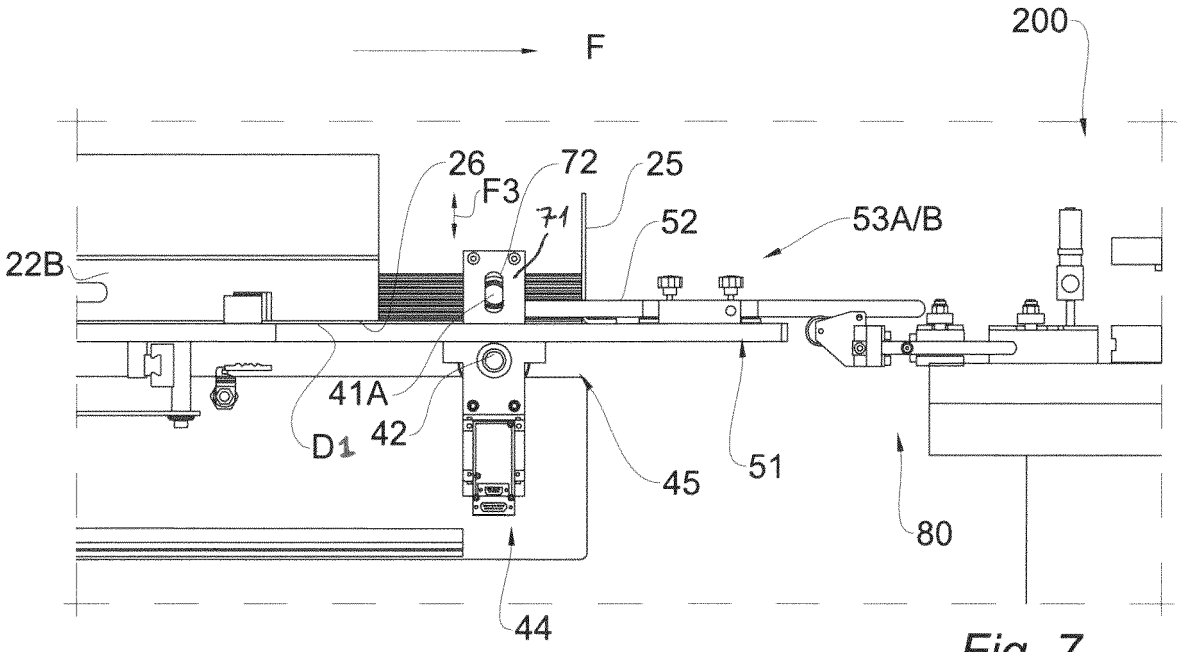
F
200
26
F3
72
25
71
52
53A/B
22B
41A
D1
42
45
51
80
44

Fig. 7

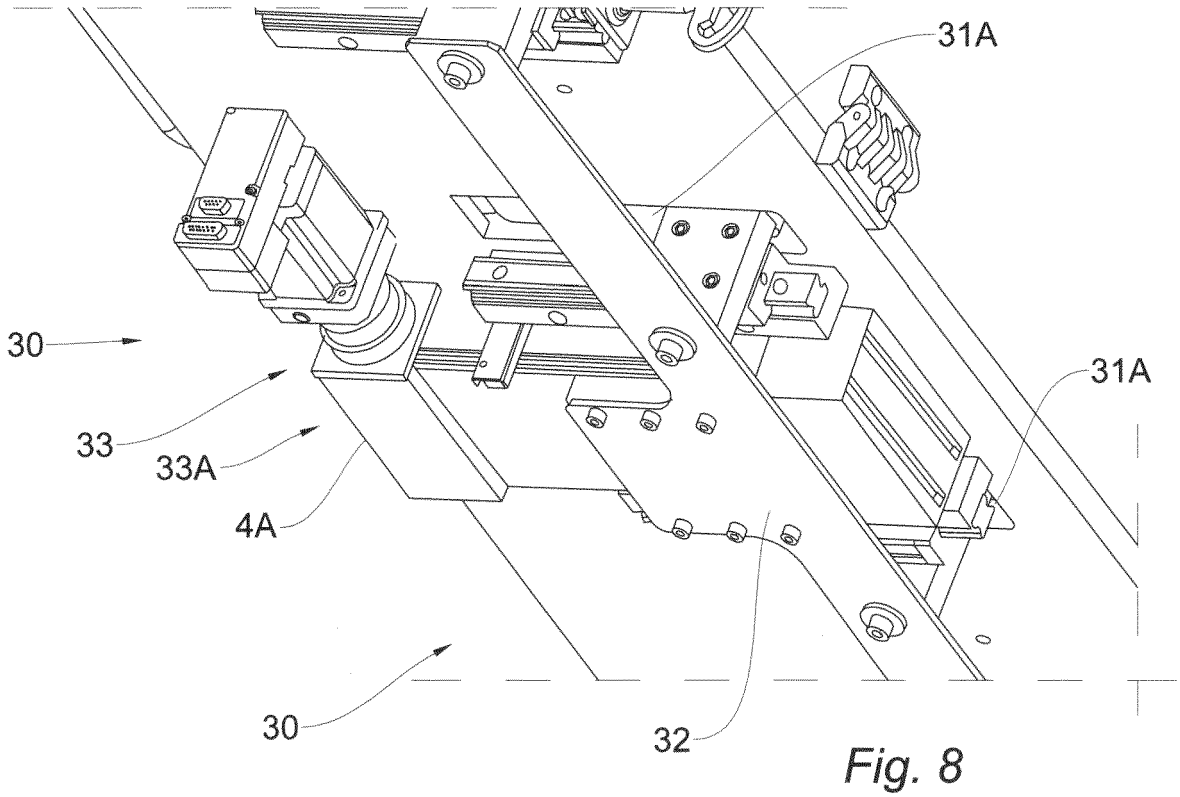
31A
30
33
33A
4A
31A
30
32

Fig. 8

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 18 7346

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	EP 2 226 123 A1 (SWITCH BVBA [BE]) 8 September 2010 (2010-09-08) * the whole document *	1,2,5-13 3,14,15	INV. B65H3/24 B65H1/06 B65H5/06
A	EP 2 657 162 A1 (HUGO BECK MASCHB GMBH & CO KG [DE]) 30 October 2013 (2013-10-30) * the whole document *	1-15	
A	US 2015/028534 A1 (TOJIMA TAKAHITO [JP] ET AL) 29 January 2015 (2015-01-29) * the whole document *	1	
A	GB 2 119 761 A (ORII JIDOKI SEISAKUSHO KABUSHI) 23 November 1983 (1983-11-23) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (IPC)

B65H
B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 November 2019	Athanasiadis, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 18 7346

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-11-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2226123 A1	08-09-2010	NONE	
EP 2657162 A1	30-10-2013	NONE	
US 2015028534 A1	29-01-2015	JP 2015024911 A	05-02-2015
		US 2015028534 A1	29-01-2015
GB 2119761 A	23-11-1983	GB 2119761 A	23-11-1983
		JP S6361097 B2	28-11-1988
		JP S58187225 A	01-11-1983

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2017148216 A **[0007] [0008]**