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(54) **PACKAGING MACHINE**

(57) A packaging machine (100) comprising a first conveyor belt (10), wherein said first conveyor belt (10) carries a multiplicity of groups of products (200) arranged at a first pitch (210) of distance from each other at a first speed (v_1), a second conveyor belt (20) which carries a multiplicity of spread out packaging sheets (300) at a second linear speed (v_2), wherein said multiplicity of spread out packaging sheets (300) are arranged at a second pitch (310) of distance from each other, a third conveyor belt (30) being arranged in succession to the second conveyor belt (20), at least one roller (40) arranged between the second conveyor belt (20) and the third conveyor belt (30), wherein said at least one roller (40) engages a front portion of each spread out packaging sheet (300) carried by said second conveyor belt (20) turning it into a spread out packaging sheet engaged (304) with said at least one roller (40), wherein said at least one roller (40) rotates at such an angular speed so as to let each engaged spread out packaging sheet (304) pass from said second linear speed (v_2) to a fourth linear speed (v_4), wherein said fourth linear speed (v_4) of the engaged packaging sheet (304) is higher than the second linear speed (v_2) of the packaging sheet (300) carried by the second conveyor belt (20), wherein each engaged spread out sheet (304) is carried at the fourth linear speed (v_4) by said at least one roller (40) until a rear portion of the engaged spread out packaging sheet (304) disengages from said at least one roller (40) becoming a disengaged spread out packaging sheet (303) , wherein each spread out packaging sheet (303) is carried by said third conveyor belt (30) at a third linear speed (v_3), wherein at least a front portion of the engaged packaging sheet (304) overlaps at least a rear portion of the previous disengaged packaging sheet (303), a coupling station (110) in which said disengaged spread out packaging sheet (303) carried by said third conveyor belt (30) is coupled with said group of products (200) forming a package of packaged products (201) . (Figure 2) .

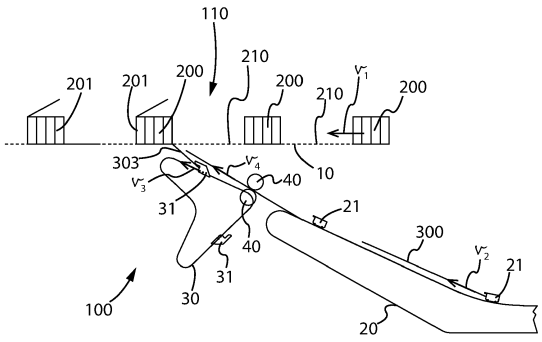

Fig. 2

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Description

[0001] The present invention relates to a packaging machine.

[0002] In the state of the art, packaging machines are known which use a cardboard support to package a multiplicity of products such as cans, bottles or cartons. The packaging machines are structured in such a way that they have a supply on two levels. The product is arranged in groups of products to be packaged. The groups of products pass at a fixed pitch between each other on a horizontal plane, while the carton that serves as a support for the creation of the packages also passes at a fixed pitch on a lower level. The pitch between one carton and the next is longer than the entire length of the spread out carton. The stored cartons are taken out one by one and deposited on a transfer means, which is a stripping station. The stripping station usually comprises a single belt or chain or, more generally, a single conveyor belt. The conveyor belt comprises profiles or prongs which are notches arranged substantially at the pitch of the cartons themselves so that the profiles push the carton from the back of the carton to transfer it from the stripping station to a coupling station with the product to obtain a package. Let us consider, for example, a "wraparound" carton, i. e. a carton which is wrapped entirely around the grouping of products to be packaged, the carton which is coupled with the product to be packaged, after the coupling itself, has a rear portion which is called the tail. This tail, together with the length of the products to be packaged, reduces the usable space in which the step of introducing the next spread out carton into the coupling station can be performed. Disadvantageously, if the packaging speed is to be increased, there is a dynamic problem.

[0003] The dynamic problem is due to the fact that when a higher packaging speed is required, it is necessary to increase the linear advancement speed of the grouping of products, the advancement speed of the spread out cartons and the introduction speed of the spread out carton into the coupling station. It is not possible to increase the speed beyond a certain physical/technological limit, because once certain linear speed values are exceeded, instability phenomena may occur which lead to the overturning of the groups of products to be packaged.

[0004] In order to overcome these problems, the known technique reduces the product advancement rate, so that the linear speed of the product groups to be packaged is reduced when a production rate is set. While this has a benefit in terms of container stability, it has a detrimental effect on the insertion of the flat carton, as the reduction in pitch has a detrimental effect on the useful space for inserting the spread out carton between one group of products and another, with negative consequences for the maximum length of the spread out carton and therefore the maximum package size. The known technique calls for increasing the speed at which the carton is introduced. Unfortunately, this parameter also has physical and technological limits, since above certain speeds it is no longer possible to physically control the correct introduction of the carton, since fluid-dynamic viscosity effects arise, which disadvantageously determine a so-called sail effect that makes the spread out carton fly out of the conveyor belt in an uncontrolled manner, hitting the group of products in the coupling station and not allowing the correct packaging of the products to be packaged.

[0005] Disadvantageously, known solutions lead to continuous jamming of the packaging carton and machine downtime.

[0006] The object of the present invention is to provide a safe and fast packaging machine which overcomes the disadvantages of the prior art and enables several groups of products to be packaged more quickly than packaging machines of the prior art.

[0007] According to the invention, such object is achieved with a packaging machine according to claim 1.

[0008] Another object of the present invention is to provide an automatic packaging process to make a packaging machine safe and fast which overcomes the disadvantages of the known technique and enables to package several groups of products faster than the processes used by packaging machines of the prior art.

[0009] In accordance with the invention this other object is achieved by an automatic packaging process according to claim 11.

[0010] Other features are provided in the dependent claims.

[0011] The features and advantages of the present invention will be more apparent from the following description, which is to be understood as exemplifying and not limiting, with reference to the appended schematic drawings, wherein:

figure 1 is a schematic view of a first operating step of a packaging machine according to the present invention;
figure 2 is a schematic view of a second operating step of the packaging machine;
figure 3 is a schematic view of a third operating step of the packaging machine;
figure 4 is a schematic view of a first operating step of an alternative packaging machine according to the present invention;
figure 5 is a schematic view of a second operating step of the alternative packaging machine;
figure 6 is a schematic view of a third operating step of the alternative packaging machine.

[0012] With reference to the mentioned figures and in particular figures 1-3, a packaging machine 100 comprising a first conveyor belt 10 is shown.

[0013] The first conveyor belt 10 is arranged at a first level above the ground.

[0014] The first conveyor belt 10 transports a multiplicity of groups of products 200 arranged at a first pitch 210

of distance from each other at a first speed v_1.

[0015] The packaging machine 100 comprises a second conveyor belt 20 which carries a multiplicity of spread out packaging sheets 300 at a second linear speed v_2, wherein said multiplicity of spread out packaging sheets 300 are arranged at a second pitch 310 of distance from each other.

[0016] The packaging machine 100 comprises a third conveyor belt 30 which is arranged in succession to the second conveyor belt 20.

[0017] The second conveyor belt 20 and the third conveyor belt 30 comprise at least a transport portion of said spread out packaging cartons 300, 303 that is on the same geometric plane, wherein the latter geometric plane intercepts the level of the first conveyor belt 10 at a coupling station 110 of the packaging machine 100.

[0018] The packaging machine 100 comprises two rubber-coated rollers 40 arranged between the second conveyor belt 20 and the third conveyor belt 30.

[0019] The two rollers 40 engage a front portion of each unfolded packaging carton 300 transported by said second conveyor belt 20, making it become a spread out packaging carton engaged 304 with the two rollers 40.

[0020] The two rollers 40 rotate at such an angular speed so as to let each engaged spread out packaging carton 304 pass from said second linear speed v_2 to a fourth linear speed v_4, wherein said fourth linear speed v_4 of the packaging carton 304 is higher than the second linear speed v_2 of the packaging carton 300 carried by the second conveyor belt 20.

[0021] Preferably, the two rollers 40 are rubber-coated so as to increase friction with the surfaces of the spread out packaging carton 300 so that as they rotate they engage the spread out packaging carton 300 and transport it at the fourth linear speed v_4.

[0022] Each engaged spread out carton 304 is carried at the fourth linear speed v_4 by the two rollers 40 until a rear portion of the engaged spread out packaging carton 304 disengages from the two rollers 40 becoming a spread out packaging carton disengaged 303 from said two rollers 40, wherein each spread out packaging carton disengaged 303 from said two rollers 40 is engaged by said third conveyor belt 30 and is carried by said third conveyor belt 30 at a third linear speed v_3.

[0023] When the two rollers 40 are carrying the engaged spread out packaging carton 304, at least a front portion of the engaged packaging carton 304 overlaps with at least a rear portion of the preceding disengaged packaging carton 303 as shown in particular in figures 2 and 3.

[0024] The coupling station 110 of the packaging machine 100 envisages that said disengaged spread out packaging carton 303 carried by said third conveyor belt 30 is coupled with said group of products 200 forming a package of packaged products 201.

[0025] It is specified that preferably said second conveyor belt 20 comprises a multiplicity of first profiles 21, wherein each first profile 21 of said multiplicity of first profiles 21 pushes a rear portion of each spread out packaging carton 300 of said multiplicity of spread out packaging cartons 300 by moving said multiplicity of spread out packaging cartons 300 at said second linear speed v_2.

[0026] The multiplicity of profiles 21 is arranged at a fixed pitch and the pitch between profiles 21 is greater than the length of the spread out packaging carton 300.

[0027] Furthermore, preferably, said third conveyor belt 30 comprises a multiplicity of second profiles 31, wherein each second profile 31 of said multiplicity of second profiles 31 engages said rear portion of the disengaged spread out packaging carton 303 and pushes it at said third linear speed v_3.

[0028] It is to be noted that a pitch between successive second profiles 31 is less than a length of said spread out packaging carton 303.

[0029] Preferably, in the described embodiment, said second linear speed v_2 of the second conveyor belt 20 is on average higher than said third linear speed v_3 of the third conveyor belt 30 because the first profiles 21 are arranged at a greater pitch than the second profiles 31.

[0030] Preferably the speed of the second profiles 31 is not constant in the work cycle.

[0031] Said third linear speed v_3 of the third conveyor belt 30 is chosen as a function of the first linear speed v_1 so as to couple the packaging cartons 303 disengaged from said two rollers 40 and carried by the third conveyor belt 30 with the groups of products 200 carried by the first conveyor belt 10.

[0032] As far as operation is concerned, it is possible to define an automatic packaging process that makes the packaging machine 100 operate. Said automatic packaging process comprises a first operation of transporting a multiplicity of groups of products 200 arranged at the first pitch 210 of distance from each other at the first speed v_1 by means of the first conveyor belt 10 of said packaging machine 100.

[0033] The process comprises a second operation of transporting a multiplicity of spread out packaging cartons 300 at the second linear speed v_2 by the second conveyor belt 20 of said packaging machine 100, wherein said multiplicity of spread out packaging cartons 300 are arranged at a second pitch 310 of distance from each other.

[0034] The process comprises an acceleration operation in which at least one roller 40 of said packaging machine 100 which is arranged between said second conveyor belt 20 and said third conveyor belt 30 engages the front portion of each spread out packaging carton 300 carried by said second conveyor belt 20 turning it into a spread out packaging carton engaged 304 with said at least one roller 40.

[0035] The process comprises an overlapping operation in which said at least one roller 40 rotates at an angular speed so that each engaged spread out packaging carton 304 passes from said second linear speed v_2 to said fourth linear speed v_4, wherein said fourth linear

speed v_4 of the engaged packaging carton 304 is higher than the second linear speed v_2 of the packaging carton 300 carried by the second conveyor belt 20, wherein each engaged spread out carton 304 is carried at the fourth linear speed v_4 by said at least one roller 40 until the rear portion of the engaged spread out packaging carton 304 disengages from said at least one roller 40 becoming a disengaged spread out packaging carton 303, wherein during said overlapping operation at least one front portion of the engaged packaging carton 304 overlaps at least a rear portion of the previous disengaged packaging carton 303 as shown in figures 2 and 3.

[0036] The process comprises a third transport operation in which each disengaged spread out packaging carton 303 is carried by said third conveyor belt 30 at said third linear speed v_3.

[0037] The process comprises a coupling operation that takes place at the coupling station 110 of said packaging machine 100, wherein said disengaged spread out packaging carton 303 carried by said third conveyor belt 30 is coupled with said group of products 200 forming a package of packaged products 201.

[0038] Advantageously, in order to obviate the technological limitations of the prior art, the stratagem adopted is that of splitting into at least two conveyor belts 20, 30 the members which are responsible for introducing the packaging carton spread out on a work surface defined by portions of the two conveyor belts 20, 30 in succession so as to be able to carry out the coupling thereof with the group of products 200 to be packaged in the coupling station 110. By doing so, it is in fact possible to partially overlap two cartons: the packaging carton engaged 304 and the packaging carton disengaged 303 from said two rollers 40 and engaged with the third conveyor belt 30 during the step of introduction into the coupling station 110. The overlap of the two cartons 303, 304 occurs just before the coupling station 110. In this way, with the same pitch 210 between the groups of products 200, a useful space for the insertion of the packaging carton disengaged 303 from the two rollers 40 and carried by the third conveyor belt 30 is actually increased. Basically, it is as if the length of the carton to be inserted is reduced by overlapping the two cartons. In the prior art, on the other hand, a larger pitch 210 would have to be left between two groups of products 200 in order to introduce the subsequent packaging carton 303 into the coupling station 110. The natural consequence is that for the same production speed, the insertion speed v_3 of the packaging carton 303 into the coupling station 110 is advantageously significantly lower than it would be if the prior art were followed. The third speed v_3 lower than that permitted by the prior art, when an increase in packaging speed v_1 is necessary, to reach the physical-technological limit of maximum linear advancement speed v_3 of the carton 303 without any sailing effects, at a higher nominal production speed v_1.

[0039] Advantageously, the packaging machine 100 according to the present invention is safe and fast, overcomes the disadvantages of the prior art and enables several groups of products 200 to be packaged more quickly than the packaging machines of the prior art.

[0040] Alternatively, it is possible to envisage that the packaging machine 100 may also comprise a single roller 40 which, by rotating, engages the packaging carton 300, 304 making it move from the first linear speed v_1 to the second linear speed v_2.

[0041] Alternatively, there may be more than two rollers 40 in order to better engage the spread out packaging carton 300, 304.

[0042] Alternatively, at least one roller 40 may be not rubber-coated.

[0043] Alternatively, the position of the at least one roller 40 is not fixed but depends on the length of the carton itself. Essentially said at least one roller 40 is spatially arranged according to the length of the spread out carton 300, i.e. said at least one roller 40 may be positioned at any of the points of a geometric line parallel to the advancement direction of the cartons 300 ascending towards the coupling station 110. Advantageously, depending on the length of the spread out carton 300, this device allows the spread out carton 303 to be laid on the third conveyor belt 30 in a controlled manner so that the third conveyor belt 30 engages said spread out carton 303 by means of the second profiles 31.

[0044] Alternatively, it is possible for said at least one roller 40 not to be rubber-coated, but for it to have physical characteristics, for example high friction with the surface of the spread out packaging carton 300, so as to be able to engage the spread out packaging carton 303 and transport it by rotation from the second speed v_2 to the fourth linear speed v_4 imparted by the rotation of said at least one roller 40.

[0045] Alternatively, it can be envisaged that the second 20 and the third conveyor belt 30 transport the unfolded packaging carton 300, 303 without using profiles 21, 31, but other methods already envisaged in the prior art.

[0046] Alternatively said second linear speed v_2 of the second conveyor belt 20 and said third linear speed v_3 of the third conveyor belt 30 may be different and the third linear speed v_3 is in phase with the first linear speed v_1 of the first conveyor belt 10. The second speed v_2 of the second conveyor belt 20 is in phase with the fourth speed v_4 imparted to the engaged spread out packaging carton 304 imparted by said at least one roller 40. It is in fact not necessary for the second speed v_2 to be equal to the third speed v_3, in fact the second speed v_2 is related to a supply speed of a stripping station of the packaging machine 100 which supplies the second conveyor belt 20 with spread out packaging cartons 300.

[0047] Alternatively, said conveyor belts 10, 20, 30 can be chains or belts.

[0048] Alternatively, it may be contemplated that the spread out packaging carton 300, 303, 304 may be replaced more generically by a packaging sheet, which may be a die-cut sheet of cardboard as described in the

embodiment or a sheet of plastic or other material that may be used to package a group of products 200.

[0049] Still alternatively as shown in Figures 4-6, the packaging machine 100 further comprising a lifter 50 which lifts said engaged packaging carton 304 with respect to a first geometric plane defined by said at least one roller 40 and by at least one portion of the third conveyor belt 30, wherein said lifter 50 is arranged in succession to said at least one roller 40. Said lifter 50 moves in phase with the third conveyor belt 30 passing from a position close to said first geometric plane suitable for intercepting said front portion of said engaged packaging carton 304 from underneath as shown in figures 4 and 5 to a lifting position with respect to said first geometric plane that lifts said engaged packaging carton 304 as shown in figure 6 until it intercepts a geometric plane above which the first conveyor belt 10 lies at the coupling station 110.

[0050] Advantageously, said lifter 50 allows an angle of insertion into the coupling station 110 of the engaged packaging carton 304 to be increased with respect to the disengaged packaging carton 303 preceding it.

[0051] Even more advantageously according to the last proposed alternative, the process comprises a lifting operation in which said lifter 50 allows an angle of insertion into the coupling station 110 of the engaged packaging carton 304 to be increased with respect to the disengaged packaging carton 303 preceding it.

[0052] The invention thus conceived is susceptible to many modifications and variants, all falling within the same inventive concept; furthermore, all details can be replaced by equivalent technical elements. In practice, the materials used, as well as their dimensions, can be of any type according to the technical requirements.

Claims

1. A packaging machine (100) comprising a first conveyor belt (10), wherein said first conveyor belt (10) carries a multiplicity of groups of products (200) arranged at a first pitch (210) of distance from each other at a first speed (v_1),

   a second conveyor belt (20) which carries a multiplicity of spread out packaging sheets (300) at a second linear speed (v_2), wherein said multiplicity of spread out packaging sheets (300) are arranged at a second pitch (310) of distance from each other,
   a third conveyor belt (30) being arranged in succession to the second conveyor belt (20),
   at least one roller (40) arranged between the second conveyor belt (20) and the third conveyor belt (30), wherein said at least one roller (40) engages a front portion of each spread out packaging sheet (300) carried by said second conveyor belt (20) turning it into a spread out packaging sheet engaged (304) with said at least one roller (40), wherein said at least one roller (40) rotates at such an angular speed so as to let each engaged spread out packaging sheet (304) pass from said second linear speed (v_2) to a fourth linear speed (v_4), wherein said fourth linear speed (4) of the engaged packaging sheet (304) is higher than the second linear speed (v_2) of the packaging sheet (300) carried by the second conveyor belt (20), wherein each engaged spread out sheet (304) is carried at the fourth linear speed (v_4) by said at least one roller (40) until a rear portion of the engaged spread out packaging sheet (304) disengages from said at least one roller (40) becoming a spread out packaging sheet disengaged (303) from said at least one roller (40), wherein each spread out packaging sheet (303) disengaged from said at least one roller (40) is engaged by said third belt conveyor (30) and is carried by said third conveyor belt (30) at a third linear speed (v_3),
   wherein at least a front portion of the engaged packaging sheet (304) overlaps at least a rear portion of the previous disengaged packaging sheet (303),
   a coupling station (110) in which said disengaged spread out packaging sheet (303) carried by said third conveyor belt (30) is coupled with said group of products (200) forming a package of packaged products (201).

2. The packaging machine (100) according to claim 1, **characterized in that** said second conveyor belt (20) comprises a multiplicity of first profiles (21), wherein each first profile (21) of said multiplicity of first profiles (21) pushes a rear portion of each spread out packaging sheet (300) of said multiplicity of spread out packaging sheets (300) moving said multiplicity of spread out packaging sheets (300) at said second linear speed (v_2),
   in that said third conveyor belt (30) comprises a multiplicity of second profiles (31), wherein each second profile (31) of said multiplicity of second profiles (31) engages said rear portion of the disengaged spread out packaging sheet (303) and pushes it at said third linear speed (v_3).

3. The packaging machine (100) according to claim 2, **characterized in that** a pitch between second profiles (31) is smaller than a length of said disengaged spread out packaging sheet (303).

4. The packaging machine (100) according to any one of claims 1-3, **characterized in that** said second linear speed (v_2) of the second conveyor belt (20) is on average higher than said third linear speed (v_3) of the third conveyor belt (30).

5. The packaging machine (100) according to any one of claims 1-4, **characterized in that** said third linear speed (v_3) of the third conveyor belt (30) is chosen according to the first linear speed (v_1) in such a way to couple the disengaged packaging sheets (303) carried by the third conveyor belt (30) with the groups of products (200) carried by the first conveyor belt (10).

6. The packaging machine (100) according to any one of claims 1-5, **characterized in that** said at least one roller (40) are two rollers.

7. The packaging machine (100) according to any one of claims 1-6, **characterized in that** said at least one roller (40) is rubber-coated.

8. The packaging machine (100) according to any one of claims 1-7, **characterized in that** said at least one roller (40) is spatially arranged along a line parallel to a direction of advancement of the spread out cartons (300) based on the length of the cartons (300).

9. The packaging machine (100) according to any one of claims 1-8, **characterized in that** said conveyor belts (10, 20, 30) can be chains or belts.

10. The packaging machine (100) according to any one of claims 1-9, **characterized in that** it comprises a lifter (50) adapted to lift said engaged packaging sheet (304) with respect to a first geometric plane defined by said at least one roller (40) and by at least one portion of the third conveyor belt (30), in which said lifter (50) is arranged in succession to said at least one roller (40), wherein said lifter (50) moves in phase with the third conveyor belt (30) passing from a position close to said first geometric plane suitable for intercepting said front portion of said engaged packaging sheet (304) from underneath to a lifting position with respect to said first geometric plane that lifts said packaging engaged sheet (304) until it intercepts a geometric plane above which the first conveyor belt (10) lies at the coupling station (110).

11. An automatic packaging process operating a packaging machine (100) according to any one of claims 1-10, wherein said automatic packaging process comprises

a first operation for transporting a multiplicity of groups of products (200) arranged at a first pitch (210) of distance from each other at a first speed (v_1) by means of a first conveyor belt (10) of said packaging machine (100),
a second operation for transporting a multiplicity of spread out packaging sheets (300) at a second linear speed (v_2) by a second conveyor belt (20) of said packaging machine (100), in which said multiplicity of spread out packaging sheets (300) are arranged at a second pitch (310) of distance from each other,
an acceleration operation in which at least one roller (40) of said packaging machine (100) which is arranged between said second conveyor belt (20) and said third conveyor belt (30) engages a front portion of each spread out packaging sheet (300) carried by said second conveyor belt (20) turning it into a spread out packaging sheet engaged (304) with said at least one roller (40),
an overlapping operation in which said at least one roller (40) rotates at an angular speed so that each engaged spread out packaging (304) passes from said second linear speed (v_2) to a fourth linear speed (v_4), wherein said fourth linear speed (v_4) of the engaged packaging sheet (304) is higher than the second linear speed (v_2) of the packaging sheet (300) carried by the second conveyor belt (20), wherein each engaged spread out sheet (304) is carried at the fourth linear speed (v_4) by said at least one roller (40) until a rear portion of the engaged spread out packaging sheet (304) disengages from said at least one roller (40) becoming a disengaged spread out packaging sheet (303), wherein during said overlapping operation at least one front portion of the engaged packaging sheet (304) overlaps at least a rear portion of the previous disengaged packaging sheet (303),
a third transport operation in which each disengaged spread out sheet (303) is carried by said third conveyor belt (30) at a third linear speed (v_3),
a coupling operation that takes place at a coupling station (110) of said packaging machine (100), in which said disengaged spread out packaging sheet (303) carried by said third conveyor belt (30) is coupled with said group of products (200) forming a package of packaged products (201) .

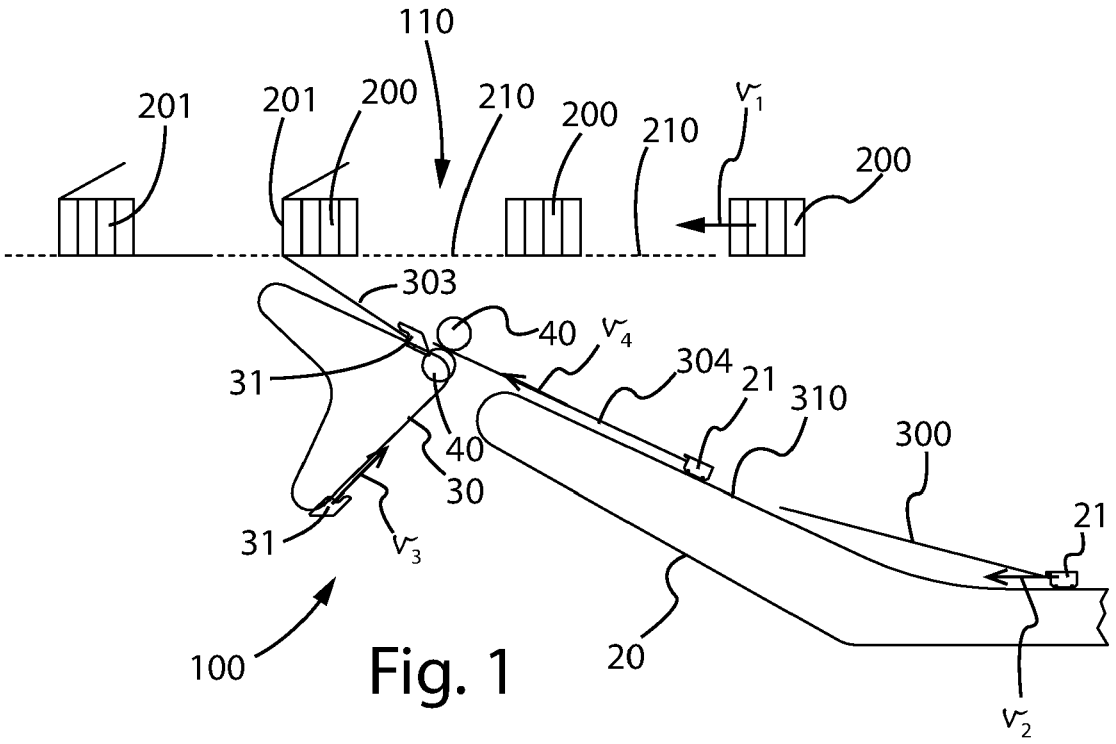
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Fig. 1

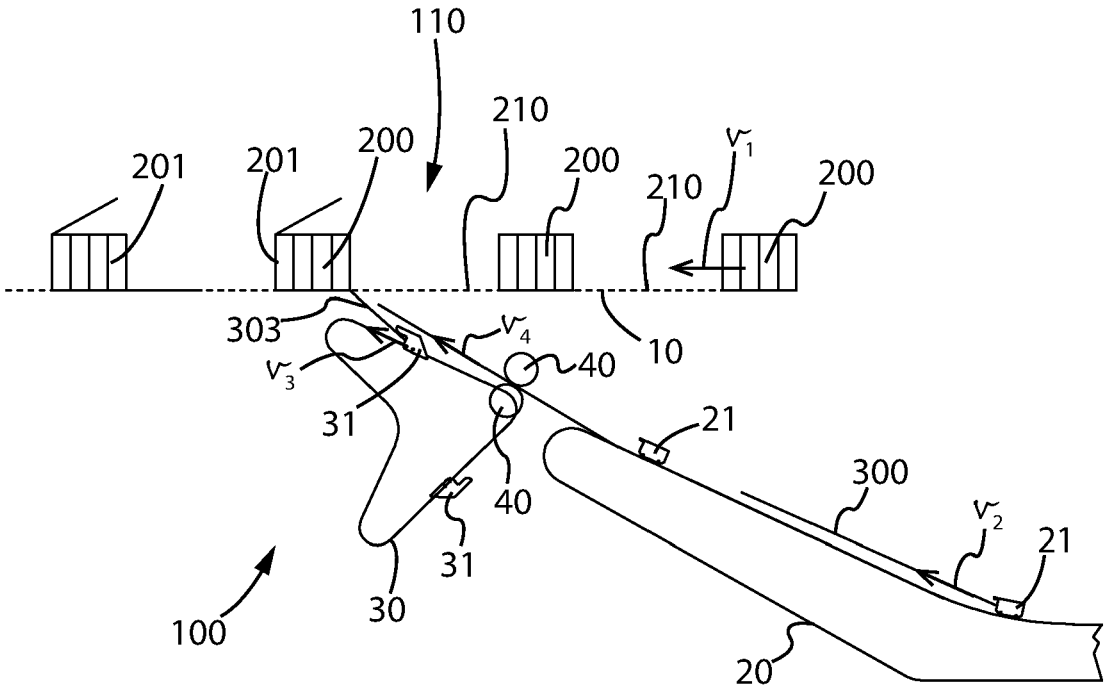
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Fig. 2

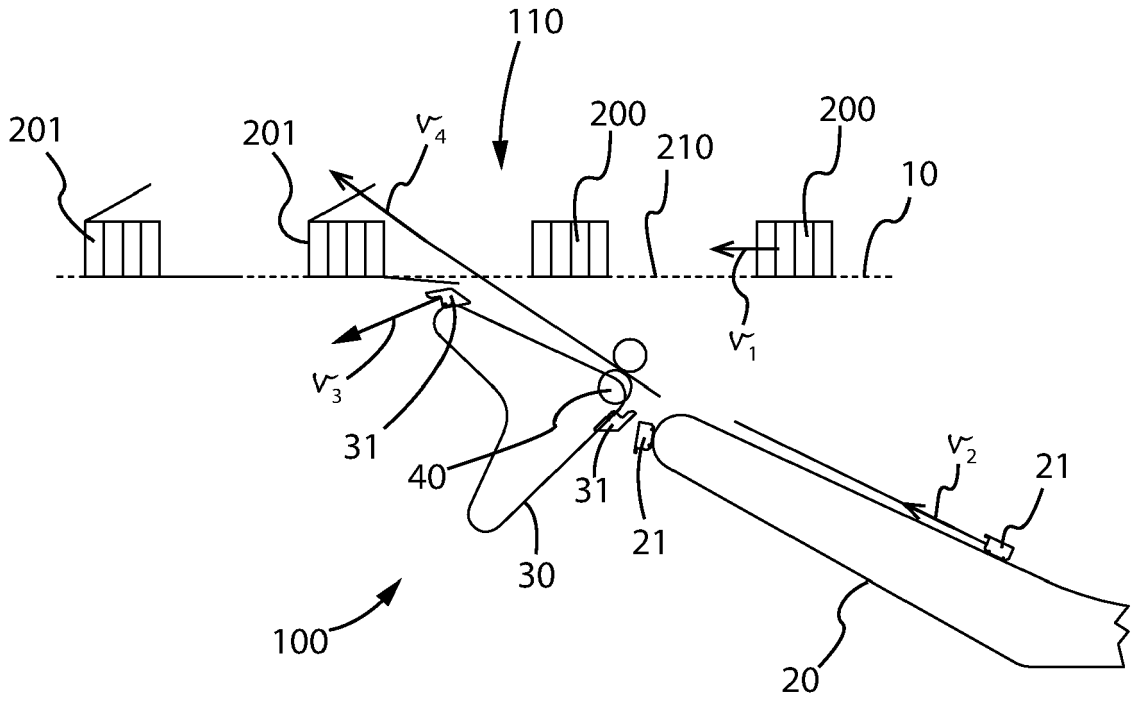
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Fig. 3

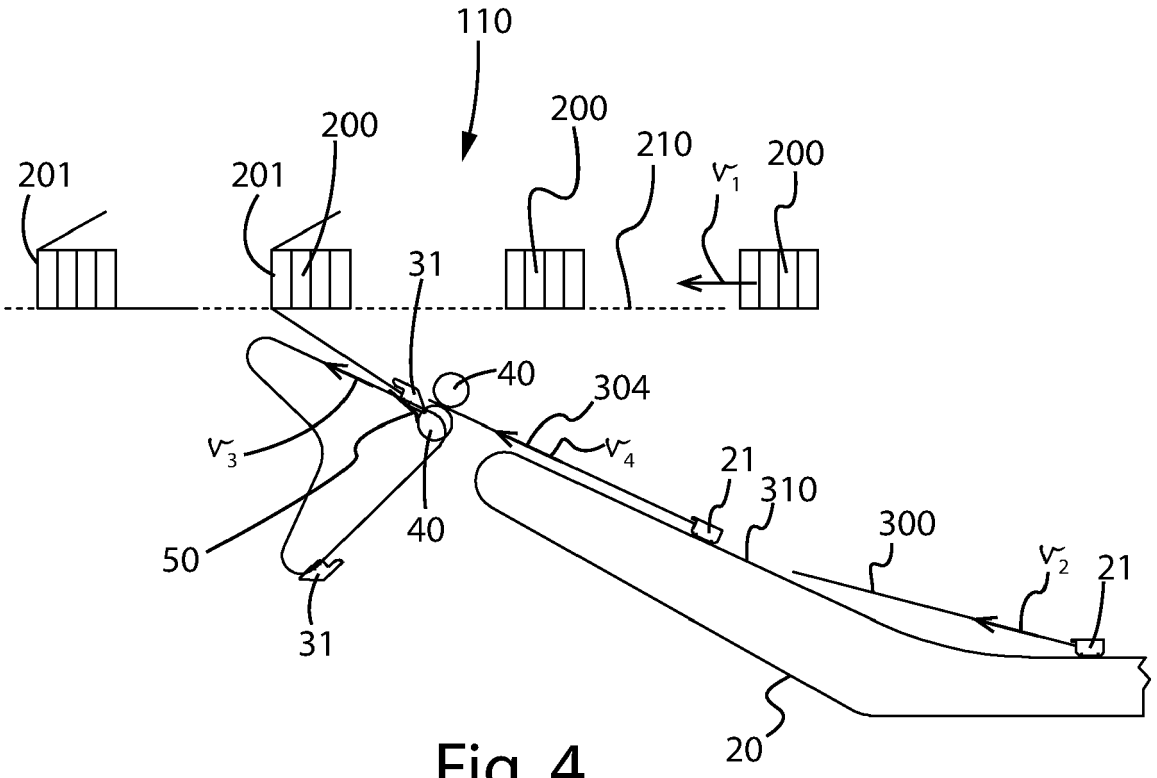
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Fig. 4

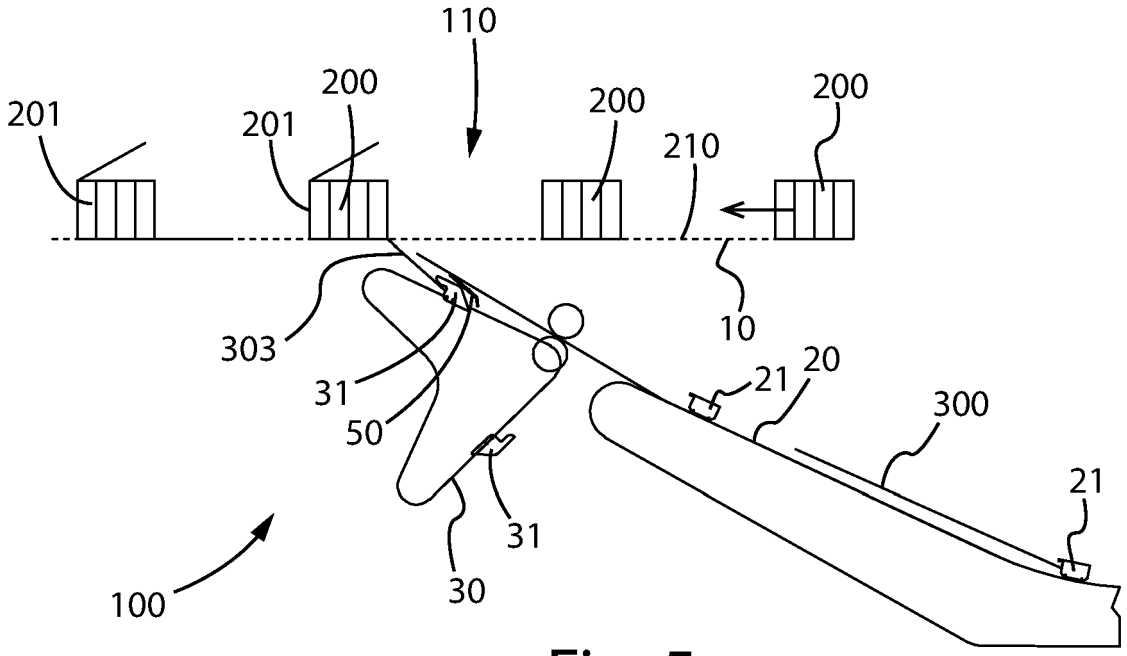
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Fig. 5

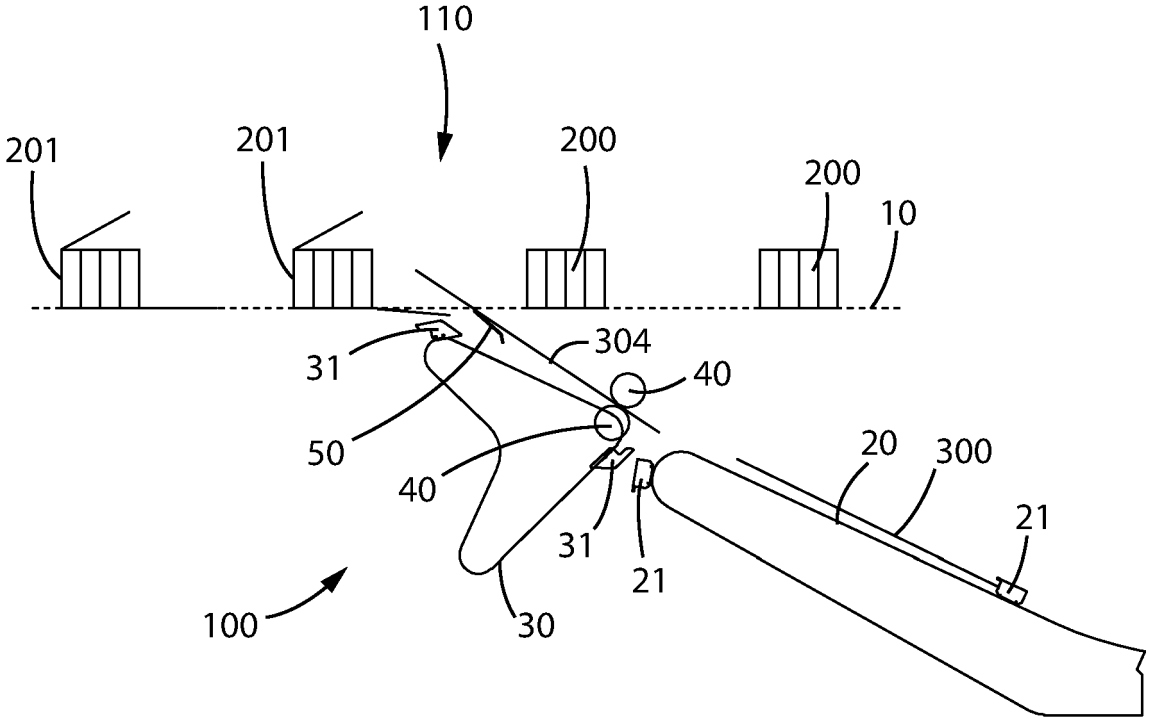
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Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 21 20 0556

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 February 2022	Lawder, M

CATEGORY OF CITED DOCUMENTS

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03-02-2022

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