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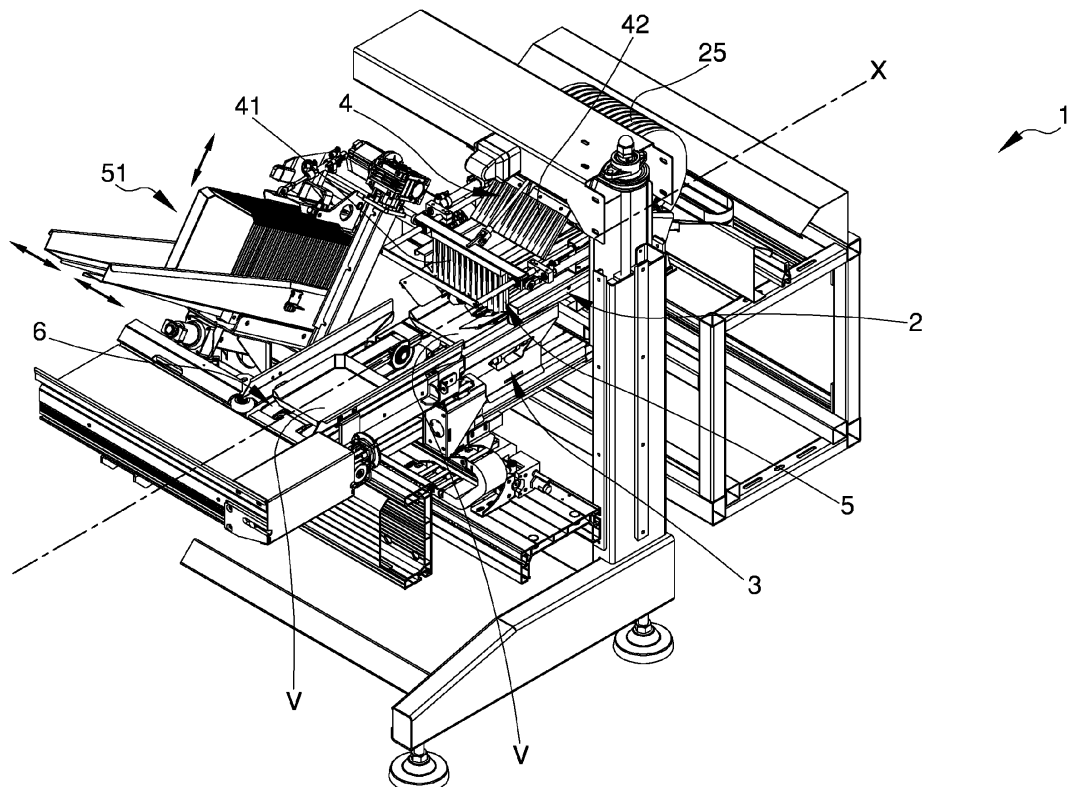
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(54) **A tray filling machine**

(57) Tray filling machine, comprising: a first conveying device (2), structured so as to transport between a loading position (C) and an unloading position (S) along a direction of transport (X) a plurality of items (F) arranged in one or more distinct rows; a second conveying device (3), structured so as to transport a tray (V) on a movement

plane (31) arranged in the proximity of the unloading position of the first conveying device (2) beneath the first conveying device; said first and second conveying devices (2,3) being synchronized in relation to each other in a manner such that the items (F) and the tray (V) transit contemporaneously at the unloading position and the items (F) can be arranged on the tray (V).

Fig. 1



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Description

[0001] The present invention relates to a tray filling machine.

[0002] The machine in question finds useful application in the fruit packaging industry, in particular for packaging fruit in trays.

[0003] Among the various methods for packaging fruit currently available on the market, packaging that envisages the use of trays intended to contain a determined number of fruits arranged in an ordered way is very common. Normally the fruits are arranged on trays in parallel rows alongside each other, so as to form a substantially ordered matrix. Once the fruits have been positioned, the trays are wrapped in a transparent film or arranged in another container which completes the packaging.

[0004] The type of packaging described briefly above is usually reserved for higher quality fruit, for which greater protection from impact and scraping is reserved, both during the packaging stage itself, and during the subsequent handling of the complete trays. For that purpose, the positioning of the fruits on the respective trays is currently performed by hand, since other automatic devices do not allow the delicacy to be obtained comparable to that obtained through manual operation.

[0005] From an economic point of view, the use of manual operations along the packaging line determines an overall increase in costs, both directly due to the high cost of labour, and in terms of the reduced flexibility of the work cycle which cannot be organized continuously but must respect pre-fixed time shifts.

[0006] The object of the present invention is to offer a tray filling machine that allows the disadvantages connected with the manual implementation of the tray filling operations to be overcome.

[0007] An advantage of the machine according to the present invention is that it allows the trays to be filled in a totally automated way and with the same delicacy obtainable by manual operations.

[0008] Another advantage of the machine according to the present invention is that it can be easily integrated in already existing packaging lines.

[0009] Further characteristics and advantages of the present invention will become clear from the following detailed description of an embodiment of the invention in question, illustrated by way of non-limiting example in the attached figures wherein:

~ Figure 1 shows a schematic axonometric view of the machine according to the present invention;

~ Figure 2 shows an enlarged detail of the machine of Figure 1;

~ Figure 3 shows the parts visible in Figure 2 in a different operative configuration;

~ Figure 4 shows the parts visible in Figure 2 in a further different operative configuration;

~ Figure 5 shows the machine of Figure 1 from a different viewpoint;

~ Figure 6 shows the machine of Figure 5 with some parts in a different operative configuration;

~ Figure 7 shows a detail of some parts of the machine;

~ Figure 8 shows the parts visible in Figure 7 in a different operative configuration;

[0010] The tray filling machine according to the present invention comprises a first conveying device 2, structured so as to transport a plurality of items F arranged in one or more distinct rows, preferably at least two distinct rows, between a loading position C and an unloading position S. The loading position C is located at an initial end of the first conveying device 2, whereas the unloading position S is located at a final end of the first conveying device 2.

[0011] The first conveying device 2 is arranged to receive the items to be packaged, in this case, round shaped fruits, from another feeding device. An example of a feeding device with which the machine according to the present invention can operate extremely effectively is represented by a selecting machine. A selecting machine is in fact able to weigh each individual fruit and send to the machine according to the present invention a determined number of fruits selected based on the weight, so as to form a tray whose weight is as close as possible to a prefixed value. The items to be packaged could however be fed to the first conveying device from machines or devices of another type.

[0012] Preferably, the first conveying device 2 comprises one or more mobile lanes 21, 22, preferably at least two, each of which being structured so as to advance a single row of items F along a first direction of transport X. As can be seen in particular in Figures 5 and 6, each lane is delimited on the underside by a pair of motorized belts 21 a, 21 b, 22a, 22b activated by a motor 220. The belts belonging to each pair are slightly inclined with respect to each other so as to form a V or in general to define a concave surface with its concavity facing downwards. Between the two pairs of belts a separating surface may be interposed, formed for example by two V-shaped inclined walls with the apex turned upwards. Containment edges 210, 211 can be positioned along the outer sides of the lanes 21, 22. Obviously, if necessary, it is possible to arrange a higher number of lanes than two.

[0013] The conformation of the first conveying device 2, and in particular the presence of the mobile lanes 21, 22, allows the items F to be fed already split into distinct rows. By determining the number of items F for each row, the first conveying device 2 therefore allows a batch of items F to be formed arranged along at least two parallel rows, and the batch thus arranged to be advanced along the direction of transport X.

[0014] The mobile lanes 21, 22 extend at least along an end tract of the first conveying device 2, that is, between an intermediate section of the first conveying device and the unloading position S. In the preferred em-

bodiment illustrated, the mobile lanes extend between the loading position C and the unloading position S.

[0015] Above the first conveying device 2, and in particular above an initial tract of the lanes 21, 22, a motorized roller 25 (Figure 1) can be advantageously positioned, or preferably a motorized roller 25 for each lane 21,22. These rollers 25 are preferably in the form of rotating brushes. The axis of rotation of each motorized roller 25 is preferably oriented in a horizontal direction. The function of the motorized rollers 25 is to promote the channelling of the items F into the lanes 21,22. For that purpose, the motorized rollers 25 are activated in rotation so as to drive the items F forwards.

[0016] The first conveying device is arranged to move the items F forwards along a substantially horizontal direction of transport X between the loading position C and the unloading position S. At the unloading position S, the mobile lanes 21, 22 are interrupted and the items F conveyed thereon are transferred from the first conveying device 2 to the second conveying device 3. In the preferred and simplified embodiment of the machine, represented in the attached figures, the items F leave the mobile lanes 21,22 by falling.

[0017] The machine according to the present invention further comprises a second conveying device 3, structured so as to convey a tray V onto a movement plane 31 arranged in the proximity of the unloading position of the first conveying device 2 beneath the first conveying device.

[0018] In the preferred embodiment illustrated in Figures 5 to 8, the second conveying device 3 comprises a movement plane 31, positioned beneath the first conveying device 2, structured so as to advance a tray V beneath the unloading position S of the first conveying device 2.

[0019] The movement plane 31 is substantially horizontal, that is, parallel to the direction of transport X of the first conveying device 2. The movement plane 31 is therefore structured so as to transport a tray V forwards along a direction of transport parallel to the direction of transport X of the first conveying device 2. In a normal operating cycle of the machine, the movements of the items F and of the tray V are synchronized in a manner such that the tray V transits below the unloading position S whereas the items F transit in correspondence with the same position. This means that the items F can be transferred from the lanes 21,22 to a tray V which is contemporaneously advancing in a parallel direction. In the preferred embodiment of the machine the items F, at the unloading position, are deposited by gravity onto a tray V below, which is contemporaneously advancing in a parallel direction. Since the distance between the lanes 21, 22 and the movement plane 31 is contained and the tray V moves parallel to the items F, the deposit of the items F within the tray itself takes place substantially without impact and without the need for manual intervention. The second conveying device 3 comprises a manipulator 32 predisposed to take a tray V from a store 51 and to release the tray on the movement plane 31. This manipulator

device 32 comprises a gripping head 33 that is mobile between a first position, wherein it can take a tray V from the store 51, and a second position, wherein it places the tray V over the movement plane 31. The gripping head 33 is for example provided with a pair of suction pads through which it can grip a tray V in correspondence with a bottom surface, as shown in Figure 5.

[0020] In the preferred embodiment, the gripping head 33 is rotatably mobile about a first horizontal axis A1 carried out by a first actuator 331. In the first position, the gripping head 33 is located in a first angular position with respect to the first axis of rotation A1. In such first angular position, the gripping head 33 is arranged substantially positioned close to the bottom of a tray V held within the store 51 (Figure 5). Preferably, in order to position itself in contact with the tray V to be taken, the gripping head 33 has the possibility to perform a movement along a perpendicular direction to the first axis of rotation A1 through an actuator 333. From the first position, wherein as has been mentioned it is possible to take a tray V, the gripping head rotates about the first axis A1 to bring itself into the second position, visible in Figure 6, wherein the tray V is arranged horizontally and can be positioned on the movement plane 31.

[0021] The second conveying device 3 further comprises a mobile frame 34 which is slidable along a second horizontal axis A2 perpendicular to the first horizontal axis A1 and to the direction of transport X carried out by a second actuator 332. The gripping head 33 is rotatably associated with the mobile frame 34 about the first horizontal axis A1. The first actuator 331 is of the linear type and is associated with the slide 34 and the gripping head 33 so as to exert on the latter an eccentric force with respect to the first axis of rotation A1.

[0022] In the preferred embodiment of the device, the movement plane 31 is also associated with the mobile frame 34. The gripping head 33 is structured so as to be able to place the tray V above the movement plane 31. As shown in Figures 5 and 6, the movement plane 31 is comprised of a pair of parallel planes between which the gripping head 33 is arranged. When the gripping head is located in its respective second position, the tray V is arranged above the movement plane 31. Preferably the gripping head 33 is also equipped with the possibility to move in a parallel direction to the movement plane 31, with the aim of advancing a tray V along the movement plane 31 itself. The movement in a parallel direction to the movement plane 31 can be obtained by means of a third actuator 333 associated with the mobile frame 34.

[0023] The mobile frame 34, along with the movement plane 31 and the gripping head 33, is slidable along the second axis A2 between a position aligned with the store 51 for the trays V (Figure 5) and a position aligned with the first conveying device 2 (Figures 7 and 8). Considering an initial position wherein the mobile frame 34 is aligned with the store 51 and the gripping head is positioned close to a tray contained in the store 51 (Figure 5), after taking the tray V itself the gripping head rotates

about the first axis A1 towards the second position in which it places the tray V above the movement plane 31. Contemporaneously or following the rotation of the gripping head 33 (Figure 6), the mobile frame 34 slides towards the alignment position with the first conveying device 2. Once that alignment position has been reached, the gripping head 33 translates in a horizontal direction parallel to the direction of transport X of the guides 21, 22 so as to make the tray V transit beneath the unloading position S of the first conveying device 2 contemporaneously to the unloading of the items F from the unloading position S itself, in a manner such that the items F are deposited without impact onto the tray V in the ways already described above, as shown in Figures 7 and 8.

[0024] Following the deposit of the items F onto the tray V, the gripping head 33 stops gripping the tray V itself which is taken and moved away by a further device, for example a mobile plane 6 of the type illustrated in Figures 2, 3, 4. The gripping head 33 and the mobile frame 34 return to the initial positions for a new cycle of operations that will bring a subsequent tray V beneath the unloading position S of the first conveying device 2 to receive a subsequent batch of items F.

[0025] In an alternative embodiment, the movement plane 31 may not be integral to the mobile frame 34, but placed in a fixed position beneath the first conveying device 2. In that case the mobile frame 34 may take on a position in which it is aligned with the movement plane 31 and the gripping head 33 arranges the tray V on the movement plane 31.

[0026] In the preferred embodiment of the machine the store 51 for the tray V is placed alongside the first conveying device 2. As illustrated in Figures 1, 5, 6 the store 51 comprises a containment structure 511 structured so as to contain a pile of trays V with the bottom facing downwards. Such containment structure 511 as a whole has a longitudinal axis that coincides substantially with the axis of the pile of trays V and is inclined diagonally with respect to a horizontal plane. The containment structure 511 comprises two profiles 511 a, 511 b that are mobile through mutual nearing and distancing, as schematically illustrated in Figure 5, so as to be adaptable to trays or containers of different sizes. The containment structure 511 further comprises an edge 511 c, intended to come into contact with the pile of trays in an opposing position to the profiles 511 a, 511 b, which is mobile along a perpendicular direction to the axis of the pile of trays in order to be adaptable to trays or containers of different sizes.

[0027] The adjustment of the position of the profiles 511 a, b and of the edge 511 c can be obtained through actuators, not illustrated in detail, controlled in a coordinated way by the machine control unit, so as to allow the operator's task to be limited to informing the machine of the tray format and the control unit to make the necessary adjustments. The store 51 is further provided with a bottom barrier 512 mobile between a closing position, wherein it holds in position the lower tray V of the pile of trays V, and an opening position, wherein it releases the

lower tray V which can be taken by the gripping head 33.

[0028] As already mentioned, the first and the second conveying devices 2, 3 are synchronized in relation to each other in a manner such that a batch of items F and a tray V transit contemporaneously at the unloading position S, in a manner such that the items F can be arranged on the tray V.

[0029] In order to facilitate the forward movement of the items F on the first conveying device 2 with respect to the movement of the trays V carried out by the second conveying device 3, each of the lanes 21, 22 may be provided with a surface braking layer (not illustrated in detail) structured so as to hinder the relative sliding movements between the lanes 21, 22 and the items F lying on the lanes 21, 22. This braking layer can be applied to the surface of the lanes 21, 22 intended to come into contact with the items F, in particular it can be applied to the surface of the motorized belts 21 a, 21 b, 22a, 22b. The braking layer can for example be constituted by a highly adhesive material that hinders sliding and rolling movements of the items F.

[0030] The presence of a braking layer allows the items F to maintain their respective position on the mobile lanes 21, 22 during the sliding of the mobile lanes 21, 22 themselves. This means that, by feeding the items F according to a predetermined time cycle to the mobile lanes 21, 22, it is possible to precisely establish the moment at which each item F reaches the unloading position S and leaves its respective mobile lane so as to be deposited into a tray V that transits contemporaneously beneath the unloading position S.

[0031] The machine according to the present invention can be provided with a synchronization device 4 structured so as to time the advancement of the items F on the first conveying device 2 with the advancement of the tray V carried out by the second conveying device 3, in a manner such that the items F and the tray V transit contemporaneously at the unloading position.

[0032] This synchronization device 4 comprises a first stop element 41 mobile between an active position, wherein it blocks advancement of the items F along the first conveying device, and an inactive position, wherein it permits advancement of the items F along the first conveying device.

[0033] In the preferred embodiment the first stop element 41 is in the form of a barrier equipped with flexibility such as not to damage the items F upon contact. In the active position, shown in Figure 2, the first stop element 41 is located in the proximity of the unloading position S of the first conveying device 2. In that position the first stop element 41 prevents the items F from falling off the lanes 21, 22. In the inactive position, the first stop element is distanced from the unloading position S and the items F are free to transit forwards. Preferably the first stop element is slidable between the active position and the inactive position along a horizontal direction parallel to the direction of transport X of the first advancement device.

[0034] Preferably the synchronization device 4 comprises a second stop element 42, located upstream of the first stop element 41 with respect to the direction of transport X, mobile between an active position, wherein it blocks advancement of the items F along the first conveying device, and an inactive position, wherein it permits advancement of the items F along the first conveying device.

[0035] The second stop element 42 is also in the form of a barrier equipped with flexibility such as not to damage the items F upon contact. In the preferred embodiment, the second stop element 42 is rotatable about a horizontal axis A3 arranged perpendicular to the direction of transport X. For that purpose, the second stop element 42 is associated with a bracket 421 rotating about the horizontal axis.

[0036] The first and the second stop elements are synchronized in relation to each other in a manner such that when one is located in its respective active position, the other is located in its respective inactive position, and vice versa. This allows a particularly efficient work cycle to be performed: starting from an initial condition wherein there are no items F on the first conveying device 2 and the second stop element 42 is located in its active position, a first batch of items F can be fed to the lanes 21, 22. The items F stop upon contact with the second stop element 42. Once the envisaged batch of items F is formed, the second stop element 42 brings itself into its inactive position and the batch of fruits F advances until it stops in contact with the first stop element 41 which has brought itself into its respective active position (Figure 2). Subsequently, the first stop element 41 brings itself into its respective inactive position to allow the batch of fruits F to be deposited on the tray V below brought into position by the second conveying device 3, while the second stop element 42 brings itself into its respective active position to allow the formation of a new batch of items F (Figures 3 and 4), and so on.

[0037] The synchronisation of the movements of the first and the second stop element 41, 42 is obtained through a mechanism that comprises a pair of linear actuators 411, associated with the first stop element and arranged to translate the first stop element along a movement direction which, preferably but not necessarily, is horizontal and parallel to the direction of transport X. A rod 412 is rotatably associated with the first stop element 41 and the bracket 421. In this way, the translation of the first stop element 41 determines, through the rod 412, the rotation of the bracket 421 and, therefore, of the second stop element 42. As can be easily understood, a forward translation of the first stop element 41 causes a downwards rotation of the second stop element 42, that is, a movement of the first stop element from its active position to its inactive position causes a contemporary movement of the second stop element from its inactive position to its active position, or vice versa.

[0038] The machine according to the present invention offers important advantages. It allows a tray to be filled

with a batch of items arranged in an ordered matrix totally automatically without the need for any manual intervention. The positioning of the items takes place with extreme delicacy, in a manner such that even items of the highest quality can be treated without the risk of suffering damage.

[0039] The machine according to the present invention can also be integrated very simply in already existing packaging lines. Advantageously, also two or more machines according to the present invention can be used in parallel to increase the productivity of the line, without needing to excessively complicate the layout of the packaging line.

Claims

1. A tray filling machine, **characterized in that** it comprises: a first conveying device (2), structured so as to transport a plurality of items (F) arranged in one or more distinct rows, between a loading position (C) and an unloading position (S) along a direction of transport (X); a second conveying device (3), structured so as to transport a tray (V) on a movement plane (31) arranged in the proximity of the unloading position of the first conveying device (2) beneath the first conveying device; said first and second conveying device (2,3) being synchronized in relation to each other in a manner such that the items (F) and the tray (V) transit contemporaneously at the unloading position and the items (F) can be arranged on the tray (V).
2. The machine according to claim 1, wherein said first conveying device (2) comprises one or more mobile lanes (21,22), each lane being structured so as to advance a single row of items (F).
3. The machine according to claim 2, wherein said mobile lanes extend at least along an end tract of the first conveying device, said end tract comprising the unloading position (S).
4. The machine according to claim 2, wherein each lane (21,22) is delimited on the underside by a pair of motorized belts (21 a, 21 b, 22a, 22b); the belts of each pair are inclined with respect to each other so as to define a concave surface with its concavity facing downwards.
5. The machine according to at least one of claims 2 to 4, wherein each one of said lanes (21,22) comprises a braking layer structured so as to hinder relative sliding movements between the lanes (21,22) and the items (F) lying on the lanes (21,22).
6. The machine according to claim 1, wherein said second conveying device (3) comprises a manipulator

(32) predisposed to take a tray (V) from a store (51) and to position the tray on the movement plane (31).

spect to each other in a manner such that when one is in its respective active position, the other is in its respective inactive position, and vice versa.

7. The machine according to claim 6, wherein said manipulator (32) comprises a gripping head (33) that is mobile between a first position, wherein it can take a tray (V) from the store (51), and a second position, wherein it places the tray (V) over the movement plane (31). 5
8. The machine according to claim 7, wherein said gripping head (33) is rotatably mobile about a first horizontal axis (A1) between the first and the second position. 10
9. The machine according to claim 6, wherein said manipulator (32) is associated with a mobile frame (34), which slides along a second horizontal axis (A2). 15
10. The machine according to claim 9, wherein said movement plane (31) is associated with the mobile frame (34). 20
11. The machine according to claim 9, wherein said mobile frame (34) is slidable along the second axis (A2) between a position aligned with the store (51) for the trays (V) and a position aligned with the first conveying device (2). 25
12. The machine according to one of the preceding claims, comprising a synchronization device (4), structured so as to time the advancement of the items (F) on the first conveying device (2) with the advancement of the tray (V) carried out by the second conveying device in a manner such that the items (F) and the tray (V) transit contemporaneously at the unloading position and the items (F) can be arranged on the tray (V). 30
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13. The machine according to claim 12, wherein said synchronization device (4) comprises a first stop element (41) that is mobile between an active position, wherein it blocks advancement of the items (F) along the first conveying device (2), and an inactive position, wherein it permits advancement of the items (F) along the first conveying device (2). 40
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14. The machine according to claim 13, wherein said synchronization device (4) comprises a second stop element (42) that is located upstream of the first stop element (41) and is mobile between an active position, wherein it blocks advancement of the items (F) along the first conveying device, and an inactive position, wherein it permits advancement of the items (F) along the first conveying device. 50
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15. The machine according to claim 14, wherein the first and second stop elements are synchronized with re-

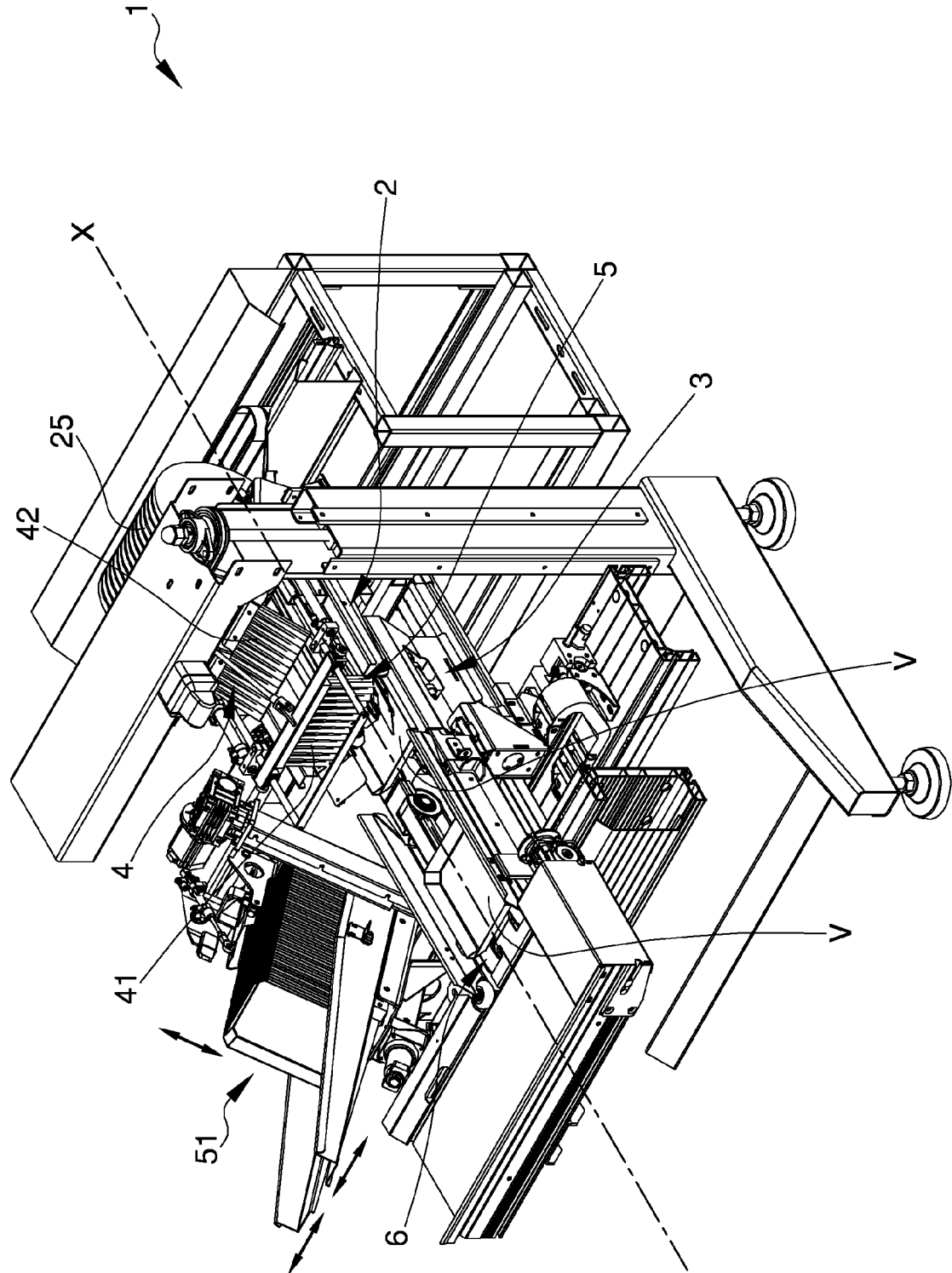


Fig. 1

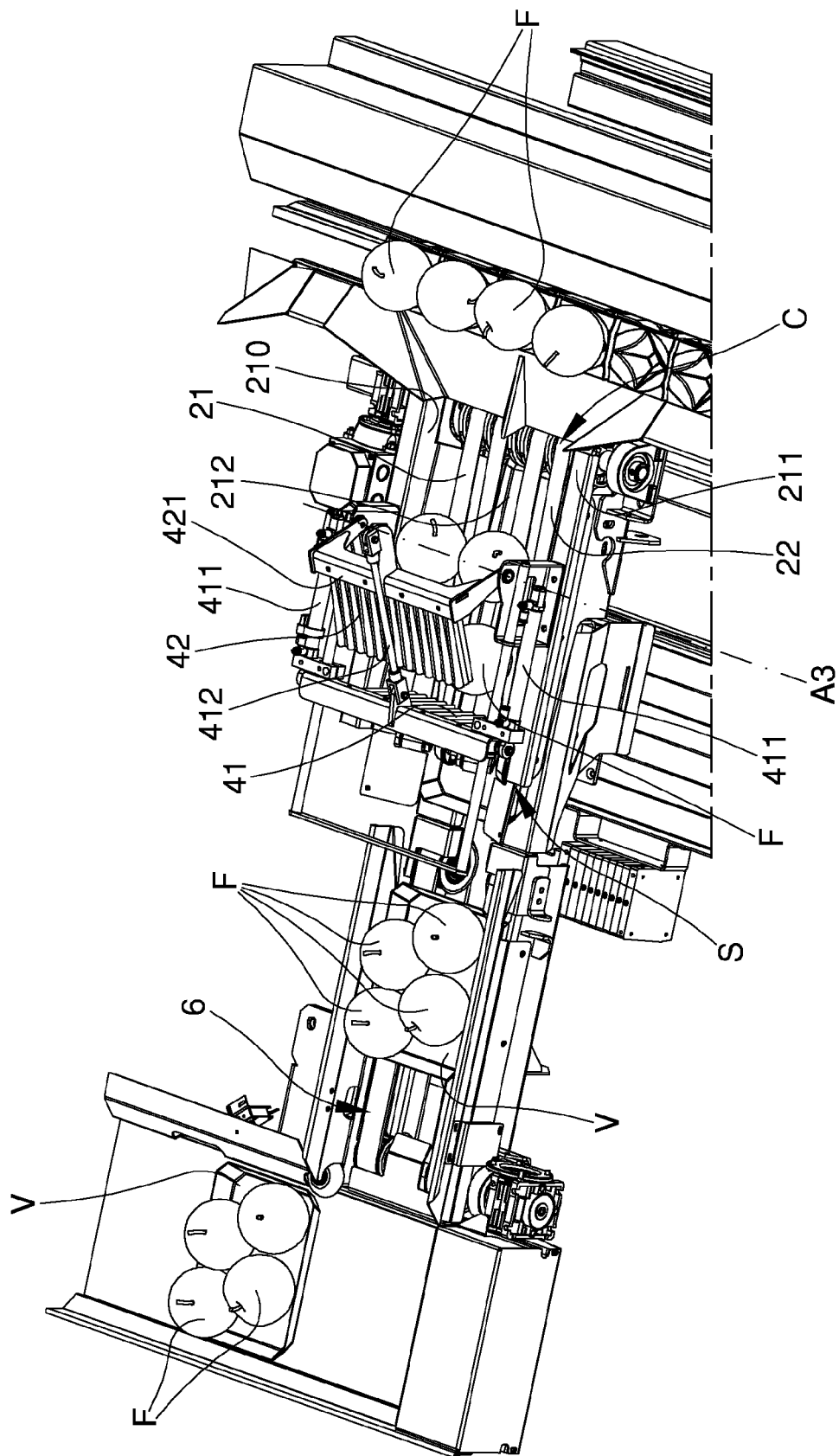
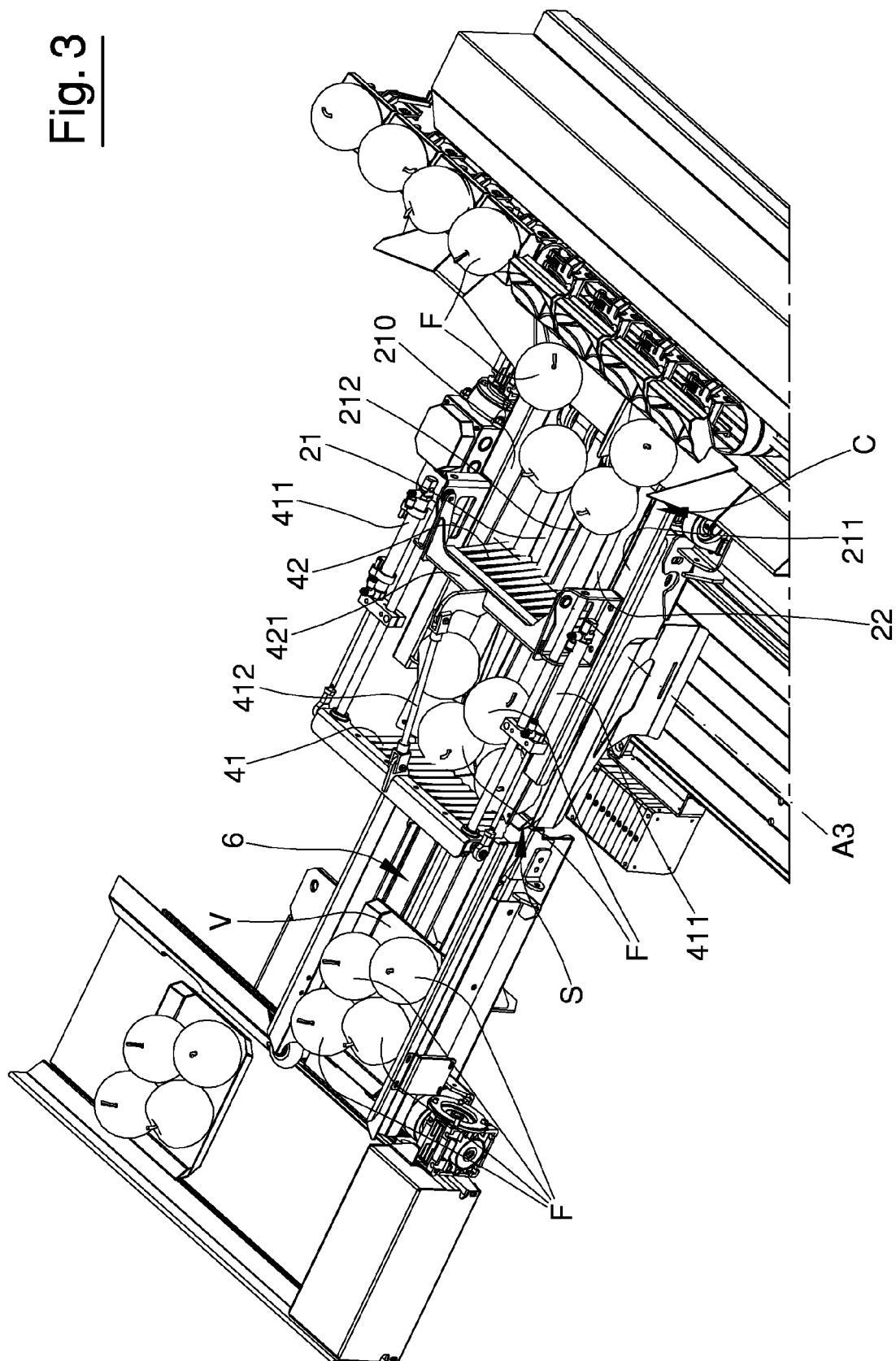


Fig. 2

Fig. 3



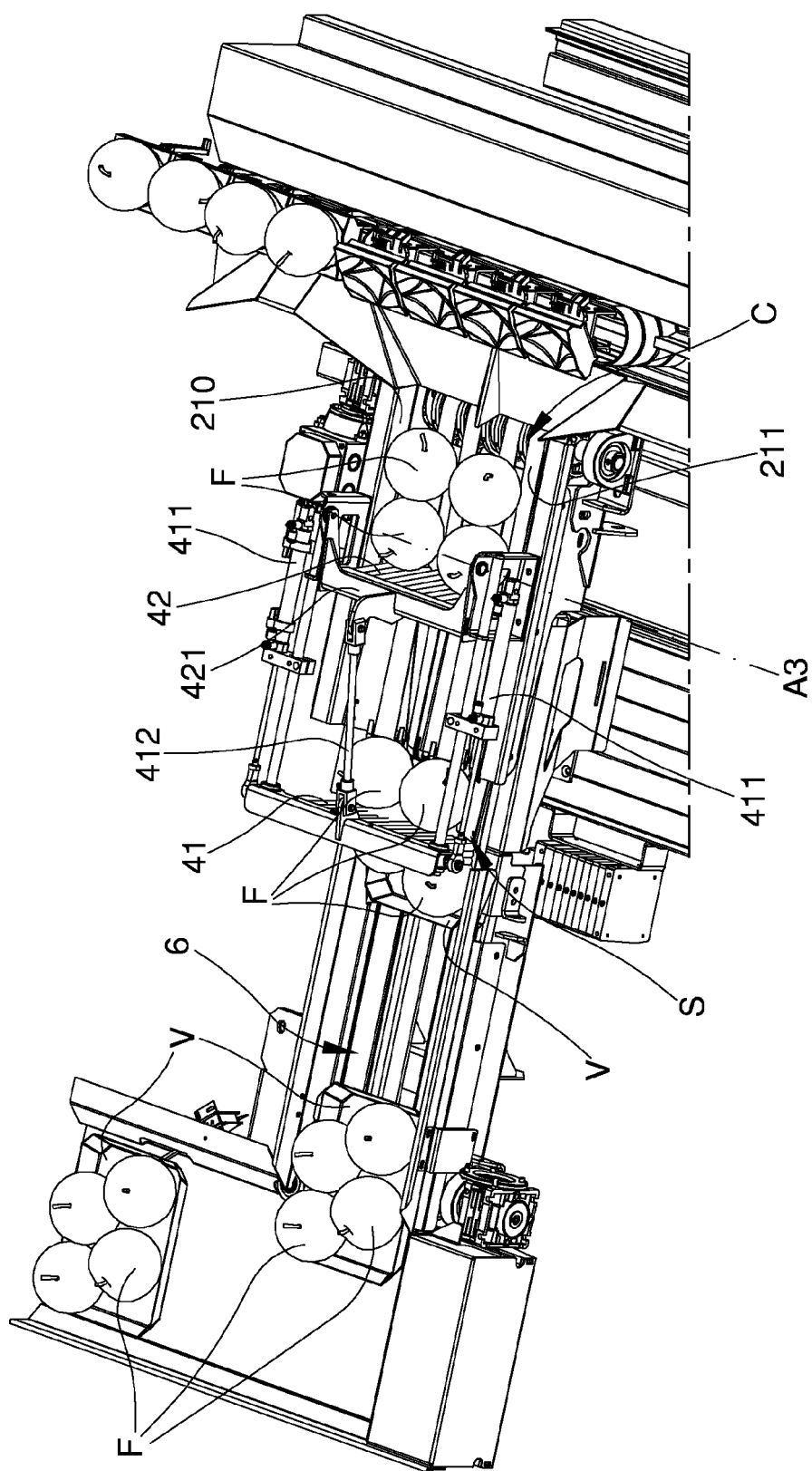
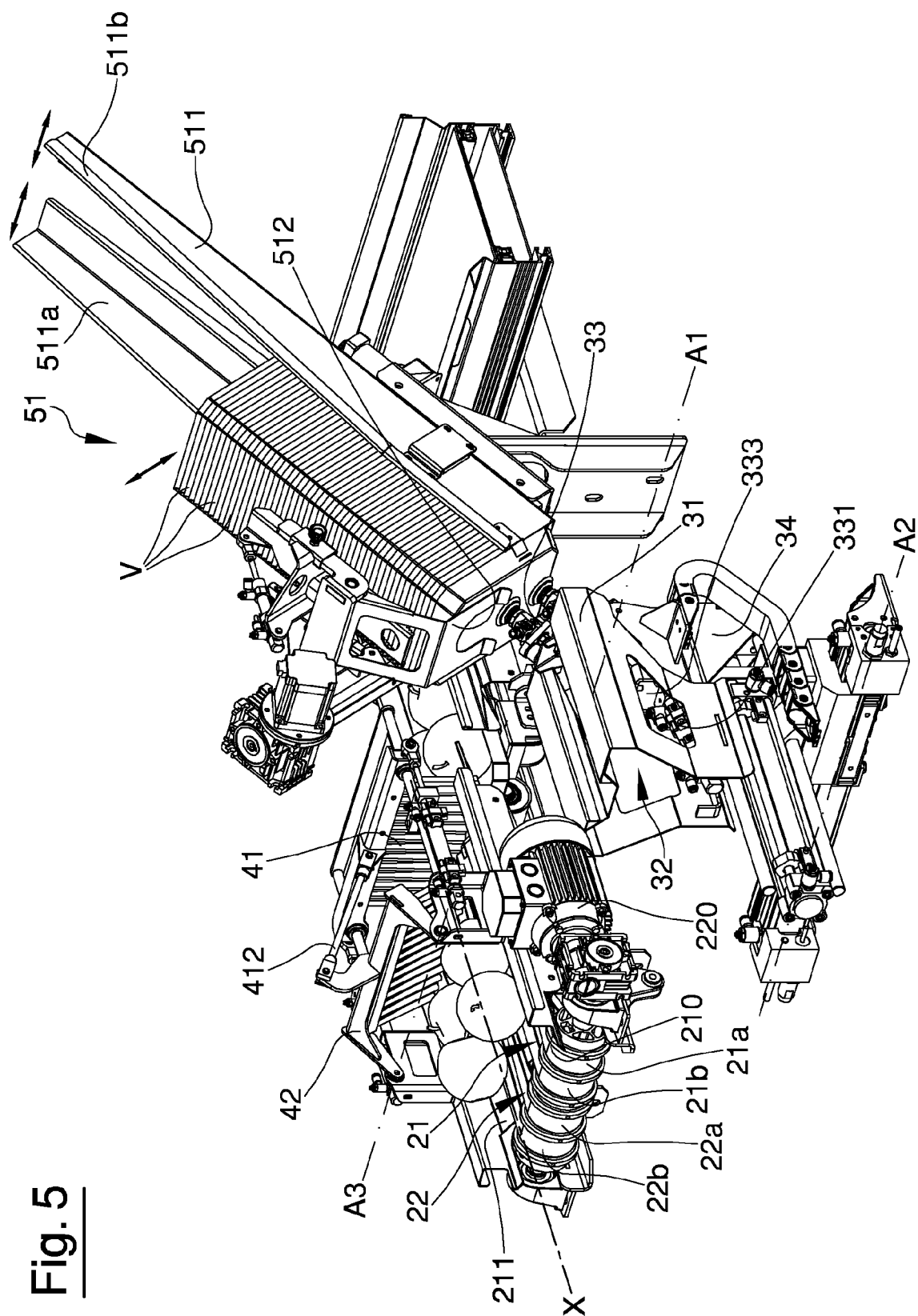


Fig. 4



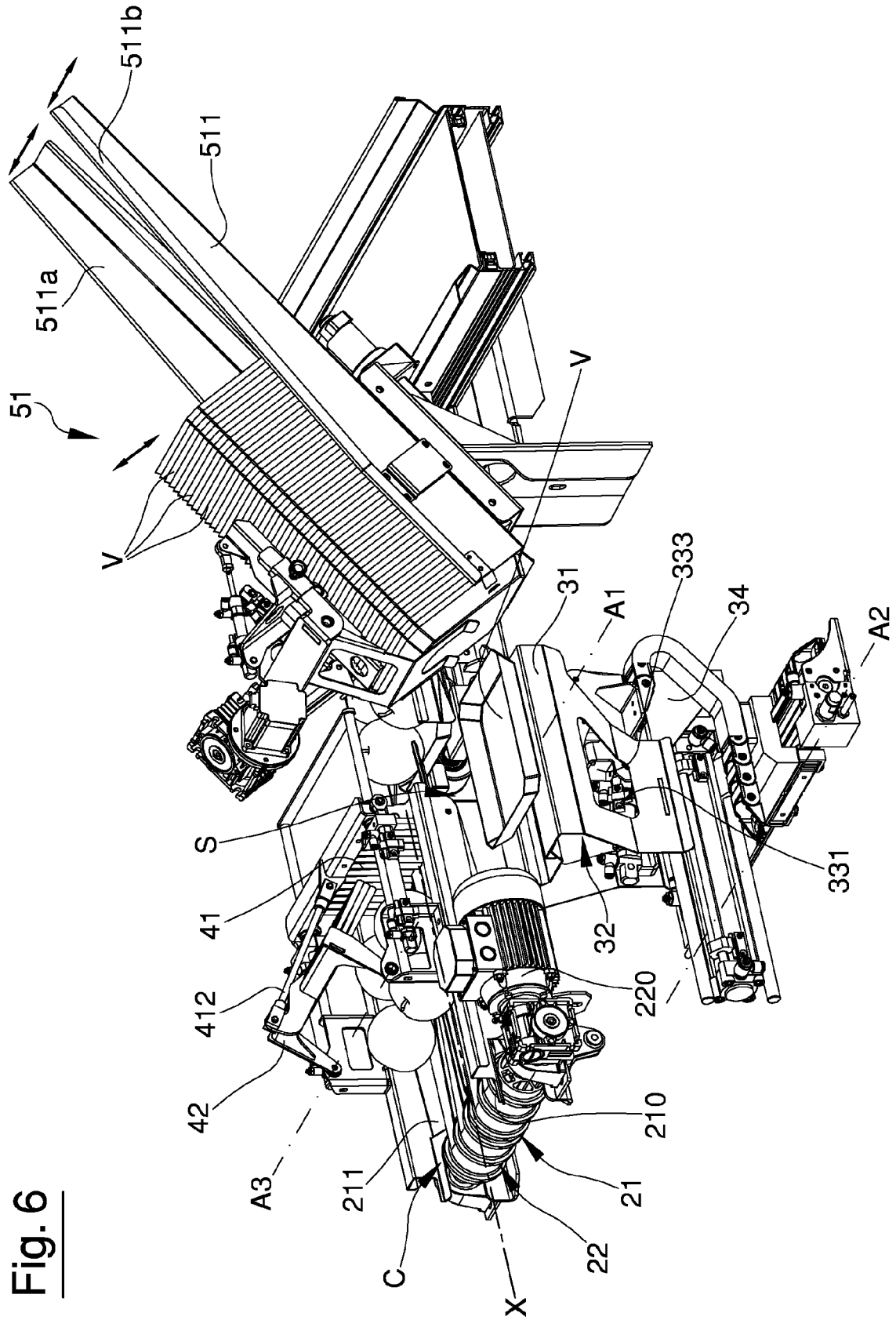


Fig. 6

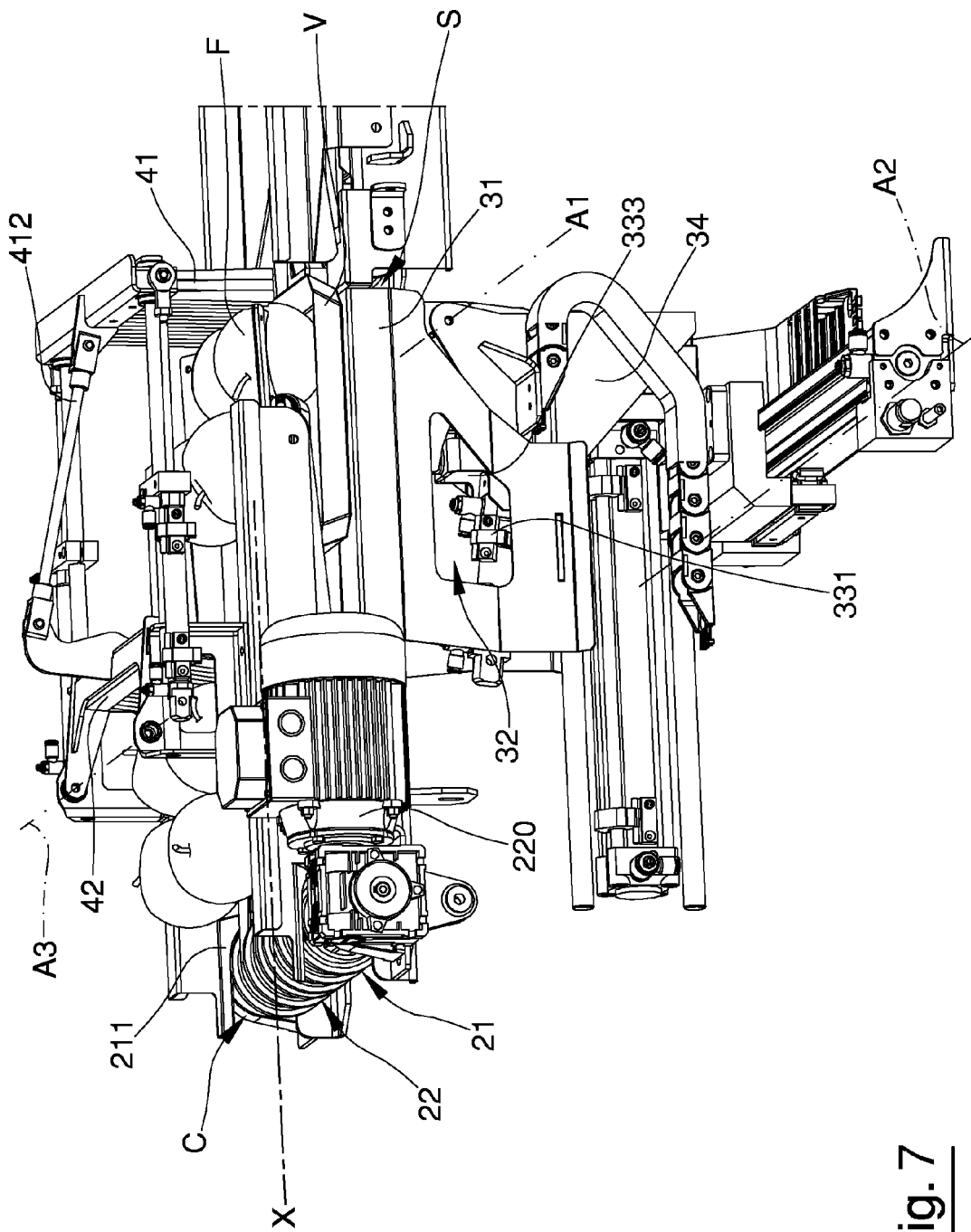


Fig. 7

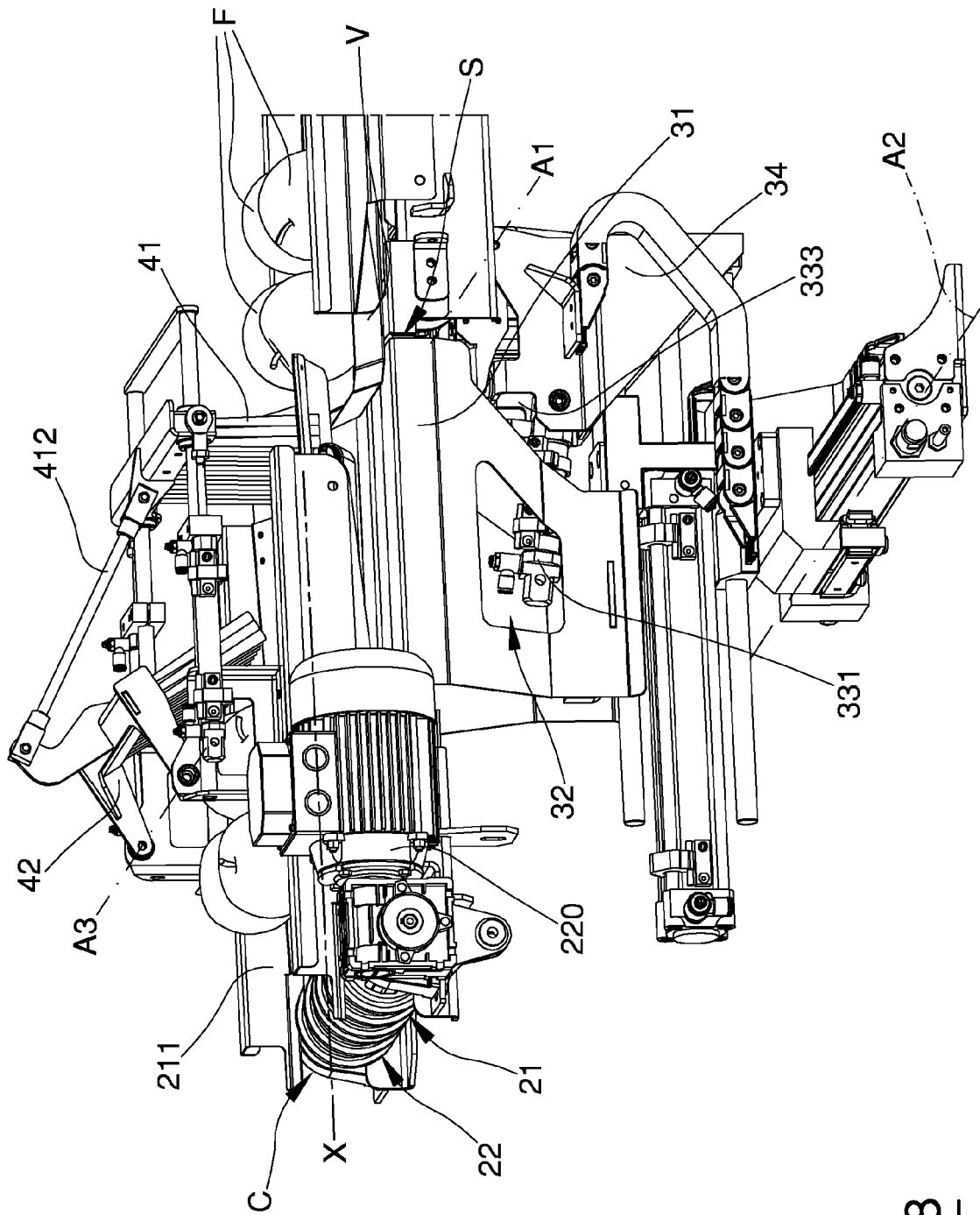


Fig. 8

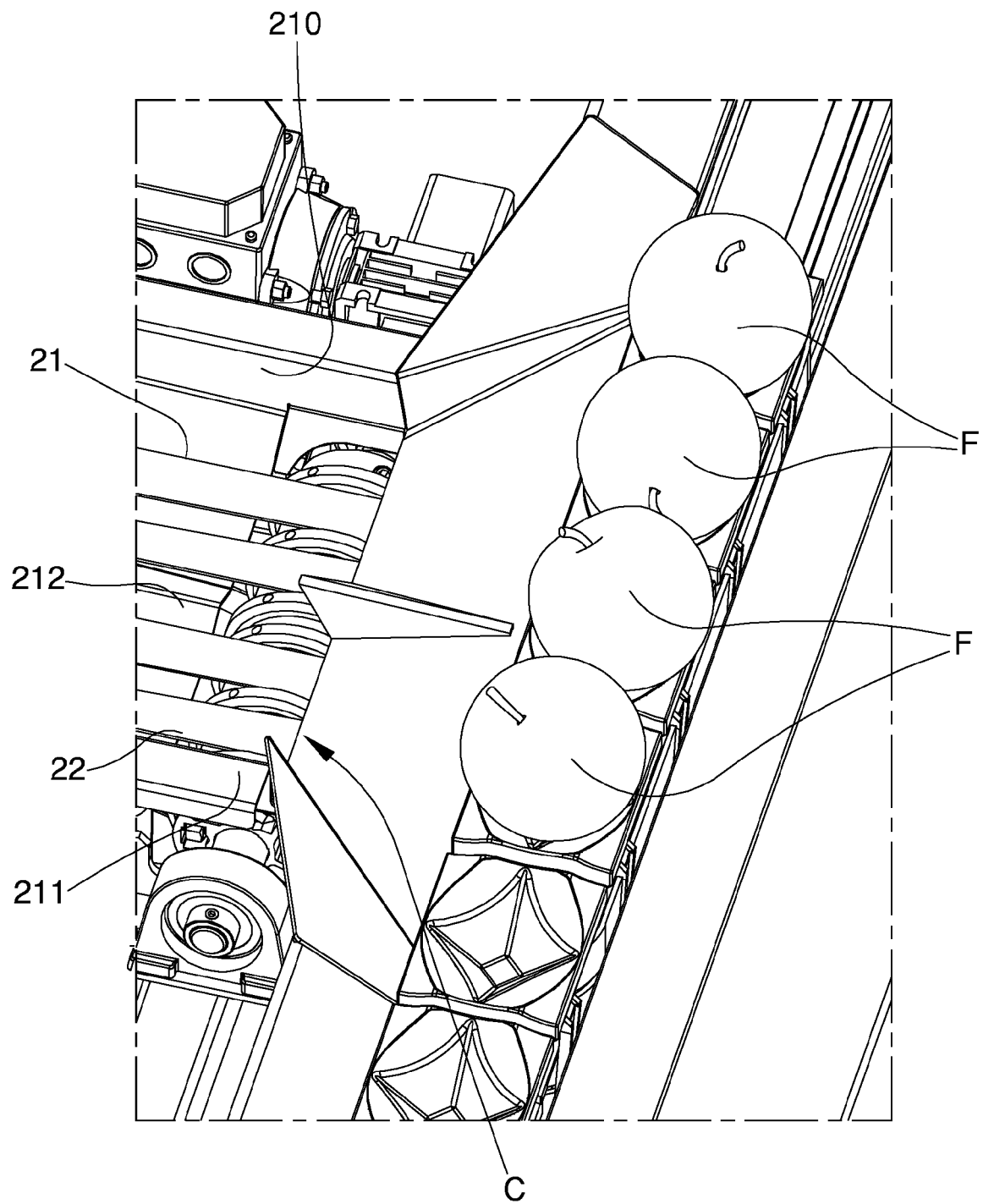


Fig. 9



EUROPEAN SEARCH REPORT

Application Number
EP 12 19 7693

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	US 4 250 684 A (CLEGG FREDERICK W) 17 February 1981 (1981-02-17) * the whole document *	1-3	INV. B65B25/04 B65B5/10
X	FR 2 342 896 A1 (BARBET ENTREPRISE [FR] BARBET ENTREPRISE) 30 September 1977 (1977-09-30) * the whole document *	1-5	ADD. B65B35/24 B65B43/44 B65B43/46 B65B57/00
X	US 2005/028495 A1 (BLANC PHILIPPE [FR]) 10 February 2005 (2005-02-10) * the whole document *	1-5	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 February 2013	Examiner Dick, Birgit
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			

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EPO FORM 1503 03.92 (P04C01)



Application Number

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
- 1-5
- ☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 12 19 7693

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-5

Tray filling machine with conveying device comprising mobile lanes

2. claims: 6-11

Tray filling machine with conveying device comprising manipulator

3. claims: 12-15

Tray filling machine with synchronization device

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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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
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26-02-2013

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