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(54) SHEET STACKER AND METHOD FOR FORMING STACKS OF STAGGERED BUNDLES

BLATTSTAPEL- UND VERFAHREN ZUR BILDUNG VON VERSETZTEN STAPELBÜNDELN

EMPILEUR DE FEUILLES ET PROCÉDÉ POUR FORMER DES PILES DE FAISCEAUX DÉCALÉS

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Description

FIELD OF THE INVENTION

[0001] The invention relates to sheet stacking devices and methods, useful for the formation of stacks of cardboard sheets, such as, but not limited to, corrugated cardboard sheets. In particular, the invention concerns sheet stacking devices and methods for the production of stacks comprised of staggered bundles of sheets.

BACKGROUND ART

[0002] In the paper industry, cardboard sheets are manufactured starting from a continuous web like cardboard material, which is slit longitudinally and divided into strips. Each strip is further divided transversely to generate a plurality of sheets of desired length. Sheets thus obtained are delivered to a so-called stacker or stacking apparatus, which forms stacks or bundles of sheets. The stacks are subsequently delivered to the final user, for example for the manufacturing of cardboard boxes or the like. Small bundles can be combined into larger stacks before shipping.

[0003] Fast advancing sheets must be carefully piled up to form stacks of regular shape. Known stacking apparatuses usually comprise a sheet conveyor arrangement which receives a substantially continuous flow of sheets which are shingled and delivered onto a stacking surface in a stacking bay.

[0004] In some cases, each stack is formed by staggered bundles, each bundle containing a predetermined number of sheets. TW-M423688U, US2014/0353119 and US2009/0169351 disclose sheet stackers configured and controlled for forming stacks of mutually staggered bundles of cardboard sheets. In order to mutually stagger neighboring bundles of the stack, said stack is formed on a horizontally movable stacker platform. The reciprocating staggering motion is in a direction substantially parallel to the feed direction of the cardboard sheets. The stacker platform comprises a conveyor belt, forming a stacking surface. The conveyor belt has a horizontal conveying motion, orthogonal to the reciprocating staggering motion of the stacker platform. The conveyor belt is used to evacuate the formed stack from the stacking bay according to an evacuation direction which is substantially orthogonal to the direction of arrival of the cardboard sheets in the stacking bay. Each bundle of a stack is formed against a single stop plate or a dual stop plate, which are arranged in two positions which are staggered along the direction of arrival of the cardboard sheets. Staggering of neighboring bundles is obtained by means of a reciprocating motion of the stacker platform in a horizontal direction. Moving the entire stacker platform is difficult and requires strong actuators and a particularly sturdy structure.

[0005] CN204057396U and CN203255778U disclose further embodiments of stackers designed and config-

ured for producing stacks of sheets, each formed by a plurality of staggered bundles. Staggering is obtained by using two mutually spaced apart stop plates. The distance between the stop plates is equal to the staggering of neighboring bundles. In addition to moving the stop plates, the sheet discharge end of the sheet conveyor must also be reciprocatingly moved back and forth in a direction parallel to the feed direction, to achieve correct staggering of adjacent bundles.

[0006] These known methods and devices for the formation of staggered bundles of cardboard sheets are expensive and cumbersome. There is still a need for improvements in stacking devices and methods capable of forming stacks of mutually staggered bundles.

SUMMARY OF THE INVENTION

[0007] According to embodiments disclosed herein, a sheet stacker is provided, which comprises:

a sheet conveyor arrangement, configured for feeding a plurality of sheets in succession in a sheet feeding direction, said sheet conveyor arrangement having a sheet discharge end;

a stacking bay, wherein sheets delivered by the sheet conveyor arrangement at the sheet discharge end thereof are formed into stacks; the stacking bay comprising a stacker platform, the sheet discharge end and the stacker platform being provided with a mutual approaching and distancing movement.

[0008] The stacker platform supports a stack conveyor movable in a direction parallel to a feed direction of the sheets in the stacking bay, configured and controlled to perform a reciprocating staggering motion to form staggered bundles of sheets, and to further perform an evacuation motion, to remove a completed stack from the stacking bay. The evacuation motion is performed in a direction parallel to the staggering motion, i.e. in the same direction of the staggering motion, or in the opposite direction.

[0009] According to some embodiments, the stacker platform can be provided with a vertical lifting and lowering movement with respect to a stationary supporting structure, such that the sheet stacker will be a so-called down-stacker, i.e. a stacker where the stacks are formed by moving the stacker platform downwardly. Formation of the stacks is thus made easier and more regular. Also, a faster operation can be obtained.

[0010] In order to orderly arrange the sheets of each stack, a stop plate can be provided, which can be positioned in the stacking bay above the stacker platform, and can be arranged and configured for stopping the sheets delivered by the sheet conveyor arrangement to the stacking bay. To facilitate the formation of staggered bundles, the stop plate can have a reciprocating vertical movement, which is synchronized with the formation of

staggered bundles of sheets.

[0011] For a smoother operation, the sheet discharge end of the sheet conveyor arrangement can be combined with an actuator, which controls a lifting and lowering movement of the sheet discharge end, which movement is synchronized with the reciprocating staggering motion of the stack conveyor.

[0012] The evacuation motion of said stack conveyor is most advantageously oriented such that the completed stack is moved from the stacking bay under the sheet conveyor arrangement, where an evacuation conveyor can be arranged. A faster operation and a more compact system having a reduced footprint is thus obtained.

[0013] The stack conveyor can comprise a single conveyor member, e.g. an endless conveyor member. In other embodiments, the stack conveyor can comprise a first stack conveyor member and a second stack conveyor member, which are sequentially arranged one after the other in a direction parallel to the direction of the evacuation motion. The first stack conveyor member and the second stack conveyor member can be arranged and controlled such that a stack is formed on the first stack conveyor member and, upon formation thereof, the completed stack is moved by the first stack conveyor member to the second stack conveyor member and sequentially by the second stack conveyor member outside the stacking bay.

[0014] The sheet discharge end can be combined with a bundle retaining device, which is configured and arranged for retaining the top-most bundle of the stack when the stack conveyor performs the staggering motion in a direction away from the sheet discharge end. Undesired displacements of the top-most sheet of a bundle upon starting formation of a subsequent, staggered bundle, are thus reduced or eliminated. The bundle retaining device can comprise at least one resilient sheet braking member, arranged under the sheet discharge end, between the sheet discharge end and the stack being formed on the stacker platform.

[0015] According to a further aspect, the invention also concerns a method of forming sheet stacks on a stacking surface, comprising the following steps:

feeding a plurality of sheets along a sheet conveyor arrangement towards a stacking bay, the sheet conveyor arrangement having a sheet discharge end, wherefrom the sheets are discharged in the stacking bay and formed into stacks on a stack conveyor supported by a stacker platform arranged in the stacking bay;

while the sheet stack gradually grows on the stacking surface, moving the stacker platform and the sheet discharge end of the sheet conveyor arrangement away from one another;

during formation of the stack, dividing the stack in mutually superposed and staggered bundles of

sheets by reciprocatingly moving the stack conveyor according to a back-and-forth staggering motion, in a direction parallel to a feed direction of the sheets in the stacking bay.

[0016] The method can further comprise a step of evacuating the stack from the stacking bay, upon completion of the stack, by moving the stack conveyor in an evacuation direction, parallel to the staggering motion thereof. The evacuation direction can be preferably oriented such that the formed stacked is transferred under the sheet conveyor arrangement.

[0017] The method can be performed in a downstacker mode of operation, i.e. the step of moving the stacker platform and the sheet discharge end away from one another comprises the step of lowering the stacker platform with respect to a stationary supporting structure.

[0018] The method can further comprise the step of lifting the sheet discharge end from the top of the stack under formation on the stacker platform when the stack under formation is moved by the stack conveyor towards the sheet discharge end during the back-and-forth staggering motion of the stack conveyor.

[0019] The method can further comprise a step of abutting the sheets coming from the sheet conveyor arrangement against a stationary stop plate arranged above the stacker platform, to perform a better alignment of the sheets. The stop plate can be reciprocatingly moved in a vertical direction in synchronism with the back-and-forth staggering motion of the stack conveyor.

[0020] When the stack conveyor comprises a first stack conveyor member and a second stack conveyor member sequentially arranged along the direction of motion of the stack conveyor; the method can be such that:

a first stack of sheets comprised of staggered bundles is formed on the first stack conveyor member;

upon completion thereof, the first stack is moved from the first stack conveyor member to the second stack conveyor member;

the first stack is evacuated from the stacking bay by the second stack conveyor member and formation a second stack of staggered bundles starts on the first stack conveyor member.

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the first stack is evacuated from the stacking bay by the second stack conveyor member and formation a second stack of staggered bundles starts on the first stack conveyor member.

[0021] Other features and advantages of the invention will be better appreciated from the following detailed description of exemplary embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] A more complete appreciation of the disclosed embodiments of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Fig.1 illustrates a side view of a sheet stacker according to the invention;

Fig.2 illustrates an enlargement of the sheet stacker of Fig.1, showing the end of the sheet conveyor arrangement and the stacking bay;

Fig.3 illustrates an enlargement of the sheet discharge end of the sheet conveyor arrangement;

Figs.4(A)-4(I) illustrate a sequence of steps of a stack-forming cycle;

Figs.5 and 6 illustrate a detail of a bundle retaining device in two different operating positions;

Fig.7 illustrates a different mode of operation of the stacker of Figs. 1-6;

Fig.8 illustrates a further embodiment of a stacker according to the invention;

Fig.9 illustrates a different mode of operation of the stacker of Fig. 8;

Fig.10 illustrates a further embodiment of a stacker according to the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0023] The following detailed description of the exemplary embodiments refers to the accompanying drawings. The same reference numbers in different drawings identify the same or similar elements. Additionally, the drawings are not necessarily drawn to scale. Also, the following detailed description does not limit the invention. Instead, the scope of the invention is defined by the appended claims.

[0024] Reference throughout the specification to "one embodiment" or "an embodiment" or "some embodiments" means that the particular feature, structure or characteristic described in connection with an embodiment is included in at least one embodiment of the subject matter disclosed. Thus, the appearance of the phrase "in

one embodiment" or "in an embodiment" or "in some embodiments" in various places throughout the specification is not necessarily referring to the same embodiment(s). Further, the particular features, structures or characteristics may be combined in any suitable manner in one or more embodiments.

[0025] Referring now to Fig.1, a sheet stacker 1 for the formation of stacks of sheets is globally labeled 1. The sheet stacker 1 comprises a sheet conveyor arrangement 3 and a stacking bay 5. According to some embodiments, as shown in Fig.1, the sheet conveyor arrangement 3 comprises a plurality of sequentially arranged sheet conveyors 3A, 3B, 3C, which define a sheet delivery path. Each sheet conveyor 3A-3C can be comprised of one or more endless flexible members, such as belts or the like, which are entrained around idle and motor-driven rollers to advance the sheets towards the stacking bay 5. The sheet conveyor arrangement 3 can be supported by a stationary supporting structure comprised of uprights 7, 9. The stationary supporting structure can further include uprights 11 and a cross member 13 surrounding the stacking bay 5.

[0026] The sheet conveyor arrangement 3 has a sheet inlet side 15 and a sheet discharge end 17. Sheets, e.g. corrugated cardboard sheets coming from a slitter-scoring or other upstream section (not shown) of the manufacturing line, enter the sheet conveyor arrangement 3 at the sheet inlet side 15 and are advanced according to a feeding direction F towards the sheet discharge end 17, where the sheets are discharged in the stacking bay 5 to form stacks of sheets as will be described later on.

[0027] Referring now to Fig.2, with continuing reference to Fig.1, the stacking bay 5 comprises a stacker platform 19 which can move vertically up and down according to arrow f19, e.g. by means of an electric motor (not shown). The stacker platform 19 can be supported by chains 20, or other lifting members, which are acted upon by an electric motor 22 to move the stacker platform 19 in a vertical up-and-down direction according to double arrow f19. The stacker platform 19 can be vertically guided by guides 21, 23 formed on uprights 9, 11. As shown in Figs 1 and 2 the stacker platform 19 supports a stack conveyor 25. The latter can be comprised of one or more endless flexible members entrained around rollers 27, 29, one of which at least is motor-driven, while the other can be idle.

[0028] The stack conveyor 25 is controlled to move back-and-forth in a substantially horizontal direction f25, parallel to the stacker platform 19 and approximately parallel to a feed direction F according to which the sheets enter the stacking bay 5. It shall be understood that the actual feed direction F of the sheets upon leaving the sheet conveyor arrangement 3 can be inclined to some extent with respect to the horizontal direction, such that the sheet feeding direction F can have an upwardly or downwardly oriented speed component when the sheets first enter the stacking bay 5. However, the sheets enter the stacking bay 5 according to a direction F which lays

in a vertical plane parallel to Figs 1 and 2 and thus parallel to the direction of motion of the stack conveyor 25. The sheets will be stacked, i.e. piled up on the stacker platform 19 in a horizontal direction. Thus the feeding direction of the sheets in the final portion of the feeding path is generally horizontal and generally parallel to the direction of motion f25 of the stack conveyor 25.

[0029] Along the cross member 13 a carriage 31 can be slidably mounted. The carriage 31 can move along guides 33 according to double arrow f31 under the control of a motor 35, e.g. through a rack-and-pinion transmission system or the like. The carriage 31 supports a stop plate 37 which can extend in a general vertical direction. The stop plate 37 can move vertically up and down according to double arrow f37 under the control of a suitable actuator, such as a cylinder-piston actuator 38, an electric or hydraulic motor, or the like.

[0030] Referring now to Fig.3, with continuing reference to Figs. 1 and 2, according to some embodiments, the sheet discharge end 17 of the sheet conveyor arrangement 3 can comprise, in a manner known to those skilled in the art, a bottom roller 41 and a top roller 45, which define in combination a sheet discharge nip, where through the sheets conveyed by the sheet conveyor arrangement 3 are discharged in the stacking bay 5. The bottom roller 41 can be a motorized roller which controls the movement of the most downstream conveyor 3C of the sheet conveyor arrangement 3. Reference number 47 designates by way of example an electric motor which controls the motion of the most downstream conveyor 3C through rotation of the bottom roller 41.

[0031] The sheet discharge end 17 of the sheet conveyor arrangement 3 can be movable in a vertical direction according to double arrow f17, e.g. under the control of a linear actuator, such as a cylinder-piston actuator schematically shown at 51, for the purpose which will become clear from the description of the sequence of operations shown in Figs. 4(A)-4(I).

[0032] Turning now back to Fig.1, under the last portion of the sheet conveyor arrangement, an evacuation conveyor 53 can be arranged, which can be positioned near the ground level G.

[0033] The operation of the sheet stacker described so far will now be described with reference to the sequence of Figs. 4(A)-4(I). According to the operation cycle described here below, the sheet stacker 1 is configured and controlled to produce stacks S of cardboard sheets C, wherein each stack S is in turn divided into bundles B, each bundle comprising a certain number of cardboard sheets C. The number of sheets of each bundle B of a stack S can be constant. As best shown in Fig. 4(A) for instance, the cardboard sheets C advance in a shingled arrangement along the sheet conveyor arrangement 3 and are individually fed through the nip 45 into the stacking bay 5. A stack S is being formed on the horizontal surface defined by the stack conveyor 25 supported on the stacker platform 19. The bundles B of sheets which form the stack S are staggered by a pitch

P. The number of sheets per bundle B, the number of bundles B per stack S and the staggering pitch P can be set by the user, e.g. through an interface of a control unit, not shown.

[0034] The bundles B are staggered in the direction F of feed of the cardboard sheets C in the stacking bay 5, i.e. in the direction of motion f25 of the stack conveyor 25. Thus, staggering of mutually superposed bundles B is obtained by means of a back-and-forth, i.e. a reciprocating staggering motion of the stack conveyor 25 according to double arrow f25.

[0035] During stacking, the stop plate 37 is located at a distance from the sheet discharge end 17 of the sheet conveyor arrangement 3, which is determined by the dimension of the cardboard sheets C in the direction F. In this way, each cardboard sheet C delivered into the stacking bay 5 will advance until reaching the stop plate 37, and all the sheets C will thus be aligned with their most advanced edges abutting against the stop plate 37.

[0036] In order to stagger the bundles B in the direction f25, once the desired number of cardboard sheets C forming a bundle B has been piled up, the stack conveyor 25 moves by a pitch P alternatively towards the sheet conveyor arrangement 3 and away therefrom. Starting from Fig. 4(A), once the top-most bundle, labeled B1 in Fig.4(A), has been completed, the stack S under formation is moved on the left according to arrow fx, such that the stack S moves slightly underneath the sheet discharge end 17 of the sheet conveyor arrangement 3. Fig. 4(B) shows the stack S in the new position, after the staggering movement according to fx has been performed.

[0037] In order to allow the trailing edges of the sheets (i.e. the most upstream edges of the cardboard sheets C with respect to the direction of feed F) of the last formed bundle B to move under the sheet discharge end 17, the stacker platform 19 can be lowered, or the sheet discharge end 17 of the sheet conveyor arrangement 3 can be lifted, or a combination of the two movements can be performed. According to presently preferred embodiments, the sheet discharge end 17 is lifted (arrow f17, Fig. 4(B)) by means of the actuator 51 and then lowered again (arrow f17, Fig. 4(C)). This movement can be quicker than a lowering movement involving the stacker platform 19, as the sheet discharge end is lighter than the stacker platform 19, which also supports the weight of the stack S under formation.

[0038] The stop plate 37 can remain stationary in this step of the stacking process, such that when formation of the subsequent bundle B2 starts, the most advance, i.e. the leading edges of the cardboard sheets C will advance until the stop plate 37, thus reaching the same position with respect to the stacking bay 5. Since the stack S has been shifted (arrow fx) towards the left by a pitch P, the next bundle B2 will be staggered by a distance P along direction F with respect to the previously formed bundle B1.

[0039] Fig.4(C) shows the initial phase of formation of the next bundle B2, while Fig.4(D) shows the subsequent

phase, where the next bundle B2 has been completed. At this stage a new bundle B3, which is staggered by a pitch P with respect to bundle B2 and aligned with the bundle B1, must be formed. For this purpose, the stack conveyor 25 is actuated and moves the stack S under formation according to arrow fy (Fig.4(E)) from the left to the right by a pitch P. The most downstream edge (i.e. the leading edge) of the bundle B2 just formed must move horizontally beyond the stop plate 37. The cylinder-piston actuator 38 thus lifts the stop plate 37 in order to allow the bundle B2 to move there under.

[0040] Once the stack S has been moved by one pitch P in the direction fy, formation of the next bundle B3 can start, as shown in Fig. 4(F). The stop plate 37 has been lowered again, such that the cardboard sheets C are correctly positioned by abutting with their leading edges against the stop plate 37. The stop plate 37 is thus controlled by the actuator 38 to perform a vertical reciprocating motion which is synchronized with the formation of staggered bundles of sheets.

[0041] In the next Fig.4(G) the subsequent bundle B3 is almost completed.

[0042] During the above described sequence, the stacker platform 19 gradually lowers to accommodate the stack S on top of the stack conveyor 25, such that the sheet discharge end 17 of the sheet conveyor arrangement 3 can remain substantially at the same height, except for the small up and down stroke according to arrow f17, which is performed by the sheet discharge end 17 each time the stack S is moved according to arrow fx to displace the trailing edge of the top-most bundle under the sheet discharge end 17. The sheet stacker is thus configured as a so-called down-stacker, i.e. the stack is formed by lowering the stack such that the upper surface thereof remains substantially around a constant position.

[0043] In order for the stack conveyor 25 to perform the bundle staggering movement, a gap in the flow of cardboard sheets 3 on the sheet conveyor arrangement 3 must be generated, which separates the last cardboard sheet C of one bundle from the first cardboard sheet C of the next bundle. The gap can be created in anyone of the known methods used to create gaps in the flow of cardboard sheets C. The dimension of the gap can be controlled on the basis of several operation parameters of the stacker 1, for instance the speed of advance of the cardboard sheets C, their length and so on.

[0044] The gap can be formed e.g. acting upon the speed of the various conveyors 3A, 3B, 3C forming the sheet conveyor arrangement 3.

[0045] The number of cardboard sheets C per bundle B can be counted in a rotary shear used to cut a continuous longitudinal cardboard web, each cut corresponding to one sheet. The last sheet of a bundle is then tracked by means of suitable encoders, for instance, along the path up to the stacking bay 5.

[0046] Once the required number of bundles B forming a stack S has been formed as described above, the stack S must be evacuated from the stacking bay 5. The evacuation

step is illustrated in Figs 4(H) to 4(I). The flow of incoming cardboard sheets C from the sheet conveyor arrangement 3 is interrupted by creating therein a gap in any one of different possible ways, known to those skilled in the art. During the time made available by the gap the formed stack S is moved downwards by lowering the stacker platform 19, as shown in Fig.4(H), until the upper surface of the stack conveyor 25 is substantially at the same level as the evacuation conveyor 53, while the stack conveyor 25 can remain inoperative, such that the stack S only moves vertically. Once this position has been achieved, the stack conveyor 25 can be activated again, to perform an evacuation motion and displace the stack S towards the evacuation conveyor 53, as shown in Fig. 4(I).

[0047] As soon as the stack S has cleared off the stacker platform 19, the latter can be lifted again, in the initial position where the formation of a new stack can start, as shown in Fig. 4(I). The time required for evacuating the stack S is extremely short, since the distance the stack S must travel substantially corresponds to the dimension of the stack in the direction F.

[0048] If the stack S has not been properly cleared off the stacker platform, e.g. if a part thereof remains on the stacker platform 19, when the latter is lifted, the remaining sheets which are still erroneously placed on the stacker platform 19 will cause an unexpected lifting movement of the sheet discharge end 17 of the conveyor 3C. This unexpected movement can be detected by a sensor, e.g. a micro-switch, which can trigger an alarm.

[0049] According to some embodiments, in order to ensure a correct piling up of the cardboard sheets C and of the bundles B, a bundle retaining device can be arranged at the sheet discharge end 17 of the sheet conveyor arrangement 3. Figs. 5 and 6 illustrate details of the bundle retaining device, globally labeled 60. In some embodiments, the bundle retaining device 60 comprises one or preferably a plurality of resilient leaf blades 61, e.g. made of metal. The resilient leaf blades 61 form a sheet braking member, which prevents or reduces undesired displacements of the cardboard sheets of the last formed bundle.

[0050] The resilient leaf blades 61 may each have a terminal bent appendage 61X, which form a surface facing the bundles B being formed. The appendages 61X can be housed in indentations 63 formed in a transverse bar 65, which can be arranged adjacent the bottom roller 41, around which the most downstream sheet conveyor 3C is entrained. The bottom of each resilient leaf blade 61 can be provided with a high-friction pad 67, e.g. made of natural or synthetic rubber, plastic material, synthetic foam material, or any other material suitable to apply a grip against the upper surface of the top-most bundle B, when the trailing edge thereof is moved under the bottom roller 41, i.e. under the sheet discharge end 17 of the sheet conveyor arrangement 3.

[0051] The operation of the bundle retaining device 60 can be best understood looking at Figs. 5 and 6 with

continuing reference to the sequence of Figs. 4(A)-4(I). In Fig.5 the sheet discharge end 17 of the sheet conveyor arrangement 3 has been lifted (arrow f17, Fig. 5) in the lifted position, in order to allow the stack under formation to move according to arrow fx, such that the last-formed bundle B1 is moved with the trailing edge thereof under the sheet discharge end 17. In this position the resilient leaf blades 61 project under the bar 65. Once the stack S has been displaced such that the bundle B1 is partly under the roller 41, i.e. the trailing edge of the bundle B1 is under the sheet discharge end 17, the latter can be lowered according to arrow f17 in Fig.6, such that the high-friction pads 67 are pressed against the upper surface of the last sheet forming the bundle B1. Formation of the next bundle B2 can start, as shown in Fig. 6, with the trailing edges of the cardboard sheets C, and thus the trailing edge of the bundle B2, abutting against the bar 65.

[0052] The cardboard sheets C are fed according to arrow F and slide along the upper surface of the previously formed bundle B1. Friction between the cardboard sheets C and the underneath bundle B1 could cause an undesired displacement of the last cardboard sheets C of bundle B1 in direction F, dragged by the next cardboard sheets C belonging to the next bundle B2. The pressure applied by the resilient laminar leaves 61 prevent the top cardboard sheet of bundle B1 from moving in direction F. When the bundle B2 has been completed, the lifting movement (arrow f17, Fig.5) of the sheet discharging end 17 of the sheet conveyor arrangement 3 releases the bundle B1, allowing the stack S to move according to fx or fy as required.

[0053] While the above description concerns a mode of operation of the sheet stacker 1 for the formation of stacks S, each formed by staggered bundles B, the same sheet stacker can also produce smooth stacks S, i.e. formed by smoothly aligned cardboard sheets C, rather than staggered bundles.

[0054] Figs. 7(A)-7(C) illustrate the final phase of formation of a smooth stack S. In order to produce smooth stacks S, the stack conveyor 25 remains stationary for the time required to pile up the desired total number of cardboard sheets C forming the stack S on the stacker platform 19, such that no staggering is provided between adjacent sheets. Fig. 7(A) shows a step in which the last cardboard sheets C are placed on top of the almost completed stack S. Since during the whole stacking process the stack conveyor 25 remained stationary, all the cardboard sheets C have been aligned against the stop plate 37, and are thus ordered to form a smooth stack S. Upon reaching the desired number of cardboard sheets C, a gap is formed in the sheet flow along the sheet conveyor arrangement 3 and the stacker platform 19 is lowered, see Fig. 7(B), arrow f19. The lowering motion brings the stacking surface, defined by the upper branch of the stack conveyor 25, in alignment with the evacuation conveyor 53.

[0055] Once this position has been achieved, the stack

conveyor 25 can be activated to perform an evacuation motion, moving the stack S in an evacuation direction fE, see Fig. 7(C), thus transferring the stack S onto the evacuation conveyor 53 and clearing the stacker platform 19.

5 This latter can be lifted again (arrow f19, Fig.7(C)), at the level of the sheet discharge end 17 of the sheet conveyor arrangement 3, to start the formation of a new stack S.

[0056] Irrespective of the kind of stack S formed (either smooth or formed by staggered bundles B), once the stack S is on the evacuation conveyor 53, there is sufficient time to remove the stack S from the sheet stacker 1, while the next stack S is formed in the stacking bay 5. The evacuation conveyor 53 can be designed in a known manner, such that evacuation of the stack S therefrom can be in a direction orthogonal to the direction F. For instance, conveyor rollers can be arranged with their rotation axes orthogonal to direction F, to move the stack under the conveyor 3C, while endless belts can be arranged between pairs of adjacent rollers, the endless belts being designed to move the stacks in a horizontal direction orthogonal to arrow fE.

[0057] In the embodiments disclosed so far, the stack conveyor 25 is formed by an endless conveyor member, which extends along the entire length of the stacking bay 5, between the two opposed rollers 27, 29. A single actuator, e.g. a single electric motor can be used to control the movement of the stack conveyor 25. In other embodiments, a different configuration of the stack conveyor 25 can be provided, e.g. the stack conveyor 25 can be comprised of sequentially arranged stack conveyor members, at least some of which are controlled by separate actuators, e.g. separate electric motors. Fig.8 schematically illustrates an embodiment wherein the stack conveyor 25 is comprised of a first stack conveyor member 25A and a second conveyor member 25B, arranged in sequence in the direction of the evacuation motion. The remaining parts, elements and components of the sheet stacker 1 of Fig.8 can be the same as described above and shown in Figs. 1-7, and will thus not be described again.

[0058] In the embodiment of Fig. 8, an auxiliary conveyor 71 is arranged on the side of the stacking bay 5 opposite the sheet conveyor arrangement 3. Depending upon the mode of operation of the sheet stacker 1, the auxiliary conveyor 71 can be used as an evacuation conveyor, or as an additional conveyor, e.g. to deliver stacking pallets or the like on the stacker platform 19. As understood herein a pallet is any means whereon the stack S of cardboard sheets C can be formed, e.g. for transportation purposes, or for other logistic reasons whatsoever.

[0059] In Fig. 8, this latter mode of operation is shown. Single pallets 73 are fed according to arrow f73 on the second stack conveyor member 25B, while the first stack conveyor member 25A is operated in quite the same way as described above, to produce stacks S of staggered bundles B (Figs. 4(A)-4(I)), or alternatively smooth stacks S (Figs. 5, 6).

[0060] Once the stack S has been completed, the first stack conveyor member 25A performs an evacuation motion, thus transferring the stack S on the evacuation conveyor 53. At the same time, or subsequently, the pallet 73, which is waiting on the second stack conveyor member 25B, can be transferred from the latter on the first conveyor member 25A. Lifting of the stacker platform 19 can start as soon as the stack S has been cleared off the first stack conveyor member 25A and/or a new pallet 73 has been transferred from the auxiliary conveyor 71 on the second stack conveyor member 25B.

[0061] In the embodiments disclosed so far, the stacks S are cleared off the stacker platform 19 by means of a clearing movement according to a direction fE which is opposite the direction F of arrival of the cardboard sheets C in the stacking bay 5, such that the stacks S are moved on the evacuation conveyor 53, which is located under the sheet conveyor arrangement 3. As mentioned above, this is particularly advantageous since it reduces the time needed to clear the stacker platform 19, thus improving the overall production rate of the sheet stacker 1. Moreover, since the evacuation conveyor 53 is arranged under the sheet conveyor arrangement 3, the overall footprint of the sheet stacker 1 is reduced.

[0062] The sheet stacker 1 of Fig. 8 can also operate in a different mode, by evacuating the stacks S from the stacking bay 5 onto the auxiliary conveyor 71, which thus performs the function of an evacuation conveyor. This mode of operation is schematically shown in Fig. 9. A completely formed stack S is shown in three subsequent positions, labeled S1, S2 and S3, respectively. It shall be noted that the above situation does normally not arise and is provided only for the sake of explanation of this mode of operation, since when a stack S is present in position S2, on the second stack conveyor member 25B, the first conveyor member 25A is cleared off.

[0063] Once the stack S1 has been completed and the stacker platform 19 is in the lower position, at the level of the auxiliary conveyor 71, the first stack conveyor member 25A and second stack conveyor member 25B can be acted upon to evacuate the stack S, moving the latter sequentially from position S1 to position S2 (arrow fS1) and from position S2 to position S3 (arrow fS2). As soon as the stack S has cleared off the second stack conveyor member 25B, the stacker platform 19 can be lifted again, to start the formation of the next stack.

[0064] The time required for clearing off the stacker platform 19 is longer than in the previously described modes of operation, since the stroke which the stack S has to travel is longer.

[0065] In both modes of operation of Figs. 8 and 9 the stacks S are formed by a plurality of superimposed and mutually staggered bundles B. It shall be understood, however, that the sheet stacker of this embodiment can be controlled to produce smooth stacks as well.

[0066] In yet further embodiments, not shown, the sheet stacker 1 can be configured as shown in Figs 8 and 9, i.e. with an auxiliary conveyor 71 possibly operat-

ing as an evacuation conveyor arranged on the side opposite the sheet conveyor arrangement, but having a stack conveyor formed by a single conveyor member 25, as illustrated in Figs. 1 to 7.

[0067] In Figs. 8 and 9 the sheet stacker 1 is provided with the evacuation conveyor 53 arranged under the sheet conveyor arrangement 1, such that the sheet stacker 1 can operate also according to any one of the mode of operations described in connection with Figs. 1 to 7. In other embodiments, however, the evacuation conveyor 53 can be omitted.

[0068] Fig. 10 illustrates a further embodiment of a sheet stacker according to the present invention. The same reference number designate the same or equivalent parts, elements or components as already described in connection with the remaining figures and which will not be described again.

[0069] The sheet stacker 1 of Fig. 10 comprises an auxiliary conveyor 81 arranged on the side of the stacking bay 5 opposite the sheet conveyor arrangement 3. The auxiliary conveyor 81 can be hinged at one end around a horizontal pivoting axis 83, which is substantially orthogonal to the direction F along which the cardboard sheets are delivered in the stacking bay 5, such that the auxiliary conveyor can pivot according to double arrow f81. In the embodiment of Fig. 10 the stack conveyor 25 is divided into first stack conveyor member 25A and second stack conveyor member 25B. In other embodiments, the stack conveyor 25 can be a one-piece stack conveyor as shown e.g. in Figs. 1-3. The sheet stacker of Fig. 10 is configured to produce bundles B1, B2, B of cardboard sheets C, which are individually downloaded from the stacking bay 5 on the auxiliary conveyor 81, which operates as an evacuation conveyor.

[0070] In Fig. 10 formation of a new bundle of cardboard sheets C has started, while the last formed bundle B2 has been transferred from the first stack conveyor member 25A on the second stack conveyor member 25B. The second last bundle B1 has been previously transferred from the second stack conveyor member 25B to the auxiliary conveyor 81.

[0071] The pivoting movement according to f81 of the auxiliary conveyor 81 allows the upstream end thereof, i.e. the end arranged near the stacking bay 5 and opposite the end pivoted at 83, to follow the upwards and downwards movement of the stack conveyor 25, such that processing of the bundles B1, B2 becomes faster. Formation of a new bundle on the first stack conveyor member 25A can start as soon as the last formed bundle B2 has cleared off the first stack conveyor member 25A and has moved on the second stack conveyor member 25B. Therefrom, the last bundle B2 can subsequently be moved onto the auxiliary conveyor 81, the upstream end whereof follows the up and down movement performed by the stack conveyor 25 to allow the next bundle to grow on the first stack conveyor member 25A.

[0072] While the invention has been described in connection with what is presently considered to be the most

practical and preferred examples, it is to be understood that the invention is not to be limited to the disclosed examples, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

Claims

1. A sheet stacker comprising:

- a sheet conveyor arrangement (3), configured for feeding a plurality of sheets in succession in a sheet feeding direction, said sheet conveyor arrangement having a sheet discharge end (17);
- a stacking bay (5), wherein sheets delivered by the sheet conveyor arrangement at the sheet discharge end thereof are formed into stacks; the stacking bay comprising a stacker platform (19), the sheet discharge end and the stacker platform being provided with a mutual approaching and distancing movement;

characterized in that the stacker platform supports a stack conveyor (25) movable in a direction parallel to a feed direction of the sheets in the stacking bay, configured and controlled to perform a reciprocating staggering motion to form staggered bundles of sheets, and to further perform an evacuation motion, to remove a completed stack from the stacking bay.

2. The sheet stacker of claim 1, wherein the stacker platform is provided with a vertical lifting and lowering movement with respect to a stationary supporting structure.

3. The sheet stacker of claim 1 or 2, further comprising a stop plate (37), positioned in the stacking bay above the stacker platform, arranged and configured for stopping the sheets delivered by the sheet conveyor arrangement to the stacking bay.

4. The sheet stacker of claim 3, wherein the stop plate has a reciprocating vertical movement, which is synchronized with the formation of staggered bundles of sheets.

5. The sheet stacker of any one of the preceding claims, wherein the sheet discharge end of the sheet conveyor arrangement is combined with an actuator, which controls a lifting and lowering movement of the sheet discharge end, which is synchronized with the reciprocating staggering motion of the stack conveyor.

6. The sheet stacker of any one of the preceding claims, wherein the evacuation motion of said stack conveyor is oriented such that the completed stack is moved

from the stacking bay under the sheet conveyor arrangement.

7. The sheet stacker of any one of the preceding claims, wherein said stack conveyor comprises a first stack conveyor member and a second stack conveyor member, which are sequentially arranged one after the other in a direction parallel to the direction of the evacuation motion.

8. The sheet stacker of claim 7, wherein the first stack conveyor member and the second stack conveyor member are arranged and controlled such that a stack is formed on the first stack conveyor member and, upon formation thereof, the completed stack is moved by the first stack conveyor member to the second stack conveyor member and sequentially by the second stack conveyor member outside the stacking bay.

9. The sheet stacker of any one of the preceding claims, wherein the sheet discharge end is combined with a bundle retaining device, which is configured and arranged for retaining the top-most bundle of the stack when the stack conveyor performs the staggering motion in a direction away from the sheet discharge end.

10. The sheet stacker of claim 9, wherein the bundle retaining device comprises at least one resilient sheet braking member, arranged under the sheet discharge end, between the sheet discharge end and the stack being formed on the stacker platform.

11. A method of forming sheet stacks on a stacking surface, comprising the following steps:

- feeding a plurality of sheets along a sheet conveyor arrangement (3) towards a stacking bay (5), the sheet conveyor arrangement having a sheet discharge end (17), wherefrom the sheets are discharged in the stacking bay and formed into stacks on a stack conveyor (25) supported by a stacker platform (19) arranged in the stacking bay;
- while the sheet stack gradually grows on the stacking surface, moving the stacker platform and the sheet discharge end of the sheet conveyor arrangement away from one another;

characterized by

- during formation of the stack, dividing the stack in mutually superposed and staggered bundles of sheets by reciprocatingly moving the stack conveyor (25) according to a back-and-forth staggering motion, in a direction parallel to a feed direction of the sheets in the stacking bay.

12. The method of claim 11, further comprising the step

of evacuating the stack from the stacking bay upon completion of the stack, by moving the stack conveyor in an evacuation direction, parallel to the staggering motion thereof.

13. The method of claim 12, wherein the evacuation direction is oriented such that the formed stacked is transferred under the sheet conveyor arrangement.
14. The method of claim 13, wherein the step of moving the stacker platform and the sheet discharge end away from one another comprises the step of lowering the stacker platform with respect to a stationary supporting structure.
15. The method of any one of claims 11 to 14, further comprising the step of lifting the sheet discharge end from the top of the stack under formation on the stacker platform when the stack under formation is moved by the stack conveyor towards the sheet discharge end during the back-and-forth staggering motion of the stack conveyor
16. The method of any one of claims 11 to 15, further comprising the step of abutting the sheets coming from the sheet conveyor arrangement against a stationary stop plate arranged above the stacker platform.
17. The method of claim 16, further comprising the step of reciprocatingly moving the stop plate in a vertical direction in synchronism with the back-and-forth staggering motion of the stack conveyor.
18. The method of any one of claims 11 to 17, wherein stack conveyor comprises a first stack conveyor member (25A) and a second stack conveyor member (25B) sequentially arranged along the direction of motion of the stack conveyor; and wherein:

a first stack of sheets comprised of staggered bundles is formed on the first stack conveyor member;
upon completion thereof, the first stack is moved from the first stack conveyor member to the second stack conveyor member;
the first stack is evacuated from the stacking bay by the second stack conveyor member and formation a second stack of staggered bundles starts on the first stack conveyor member.

Patentansprüche

1. Blattstapler mit: einer Blattförderanordnung (3), die zur Förderung einer Anzahl von Blättern in Folge in einer Blattförderrichtung ausgebildet ist, wobei die Blattförderanordnung ein Blatt-Abgabeende (17)

aufweist, einem Stapelgestell (5), wobei Blätter, die von der Blattförderanordnung an ihrem Abgabeende geliefert werden, in Stapel geformt werden, wobei das Stapelgestell eine Stapelplattform (19) aufweist, wobei das Blatt-Abgabeende und die Stapelplattform mit einer gegenseitigen Annäherungs- und Entfernungsbewegung versehen sind,

dadurch gekennzeichnet, dass die Stapelplattform einen Stapelförderer (22) aufweist, der in einer Richtung parallel zu einer Förderrichtung der Blätter in dem Stapelgestell bewegbar ist, ausgebildet und gesteuert wird, um eine hin- und hergehende Versatzbewegung durchzuführen, um versetzte Bündel von Blättern zu bilden und ferner um eine Räumbewegung durchzuführen, um einen vervollständigten Stapel von dem Stapelgestell zu entfernen.

2. Blattstapler nach Anspruch 1, wobei die Stapelplattform mit einer vertikalen Hub- und Senkbewegung mit Bezug auf eine stationäre Trägerstruktur versehen ist.
3. Blattstapler nach Anspruch 1 oder 2 mit ferner einer Anschlagplatte (37), die in dem Stapelgestell oberhalb der Stapelplattform positioniert ist, angeordnet und ausgebildet ist, um die Blätter, die von der Blattförderanordnung zu dem Stapelgestell geliefert werden, anzuhalten.
4. Blattstapler nach Anspruch 3, wobei die Anschlagplatte eine Hin- und hergehende Vertikalbewegung hat, die mit der Bildung der versetzten Bündel von Blättern synchronisiert ist.
5. Blattstapler nach einem der vorstehenden Ansprüche, wobei das Blatt-Abgabeende der Blattförderanordnung mit einem Betätigungsglied kombiniert ist, das eine Hub- und Senkbewegung des Blatt-Abgabeendes steuert, die mit der hin- und hergehenden Versatzbewegung des Stapelförderers synchronisiert ist.
6. Blattstapler nach einem der vorstehenden Ansprüche, wobei die Räumbewegung des Stapelförderers so orientiert ist, dass der vervollständigt Stapel von dem Stapelgestell unter der Blattförderanordnung bewegt wird.
7. Blattstapler nach einem der vorstehenden Ansprüche, wobei der Stapelförderer ein erstes Stapel-Förderelement und ein zweites Stapel-Förderelement aufweist, die aufeinanderfolgend hintereinander in einer Richtung parallel zu der Richtung der Räumbewegung angeordnet sind.
8. Blattstapler nach Anspruch 7, wobei das erste Stapel-Förderelement und das zweite Stapel-Förderelement so angeordnet und gesteuert sind, dass ein

Stapel aus dem ersten Stapel-Förderelement gebildet wird und, bei seiner Ausbildung, der vervollständigte Stapel von dem ersten Stapel-Förderelement auf das zweite Stapel-Förderelement bewegt wird und anschließend durch das zweite Stapel-Förderelement außerhalb des Stapelgestells bewegt wird.

9. Blattstapler nach einem der vorstehenden Ansprüche, wobei das Blatt-Abgabeende mit einer Bündel-Haltevorrichtung kombiniert ist, die ausgebildet und angeordnet ist, um das oberste Bündel des Stapels zu halten, wenn der Stapelförderer die Versatzbewegung in einer Richtung weg von dem Blatt-Abgabeende durchführt.

10. Blattstapler nach Anspruch 9, wobei die Bündel-Haltevorrichtung mindestens ein nachgiebiges Blatt-Bremselement aufweist, das unter dem Blatt-Abgabeende zwischen dem Blatt-Abgabeende und dem Stapel, der auf der Stapelplattform gebildet wird, angeordnet ist.

11. Verfahren der Ausbildung von Blattstapeln auf einer Stapelfläche mit den folgenden Schritten:

Fördern einer Anzahl von Blättern entlang einer Blattförderanordnung (3) zu einem Stapelgestell (5),

wobei die Blattförderanordnung ein Blatt-Abgabeende (17) aufweist, von dem Blätter in das Stapelgestell abgegeben werden und in Stapel auf einem Stapelförderer (25) geformt werden, der von einer Stapelplattform (19) getragen wird, die in dem Stapelgestell angeordnet ist, Bewegen der Stapelplattform und des Blatt-Abgabeendes der Blattförderanordnung voneinander weg, während der Blattstapel graduell auf der Stapelfläche wächst,

gekennzeichnet durch

während der Ausbildung des Stapels, Aufteilen des Stapels in gegenseitig überlagerte und versetzte Bündel von Blättern durch hin- und hergehende Bewegung des Stapelförderers (24) entsprechend einer vor- und zurückgehenden Versatzbewegung in einer Richtung parallel zu einer Förderrichtung der Blätter in dem Stapelgestell.

12. Verfahren nach Anspruch 11 mit ferner dem Schritt des Räumens des Stapels aus dem Stapelgestell bei Vervollständigung des Stapels durch Bewegen des Stapelförderers in einer Räumrichtung, parallel zu seiner Versatzbewegung.

13. Verfahren nach Anspruch 12, wobei die Räumrichtung so orientiert ist, dass der gebildete Stapel unter die Blattförderanordnung übertragen wird.

14. Verfahren nach Anspruch 13, wobei der Schritt des Bewegens der Stapelplattform und des Blatt-Abgabeendes weg voneinander den Schritt des Absenkens der Stapelplattform mit Bezug auf eine stationäre Trägerstruktur umfasst.

15. Verfahren nach einem der Ansprüche 11 bis 14 mit ferner dem Schritt des Anhebens des Blatt-Abgabeendes von der Oberseite des Stapels, der auf der Stapelplattform gebildet wird, wenn der Stapel, der gebildet wird, durch den Stapelförderer zu dem Blatt-Abgabeende während der vor- und zurückgehenden Versatzbewegung des Stapelförderers bewegt wird.

16. Verfahren nach einem der Ansprüche 1 bis 15 mit ferner dem Schritt des Anstoßens der Blätter, die von der Blattförderanordnung kommen, gegen eine stationäre Anschlagplatte, die oberhalb der Stapelplattform angeordnet ist.

17. Verfahren nach Anspruch 16 mit ferner dem Schritt des hin- und hergehenden Bewegens der Anschlagplatte in einer Vertikalrichtung synchron mit der vor- und zurückgehenden Versatzbewegung des Stapelförderers.

18. Verfahren nach einem der Ansprüche 11 bis 17, wobei der Stapelförderer ein erstes Stapel-Förderelement (25A) und ein zweites Stapel-Förderelement (25B) aufweist, die aufeinanderfolgend entlang der Richtung der Bewegung des Stapelförderers angeordnet sind, und wobei:

ein erster Blattstapel mit versetzten Bündeln auf dem ersten Stapel-Förderelement gebildet wird, bei Vervollständigung dessen, der erste Stapel von dem ersten Stapel-Förderelement zu dem zweiten Stapel-Förderelement bewegt wird, der erste Stapel von dem Stapelgestell durch das zweite Stapel-Förderelement geräumt wird und die Ausbildung eines zweiten Stapels von versetzten Bündeln auf dem ersten Stapel-Förderelement beginnt.

Revendications

1. Un gerbeur de feuilles comprenant :

- un appareil de transport de feuilles (3) configuré pour faire avancer une pluralité de feuilles successivement dans une direction d'avancement de feuilles, ledit appareil de transport de feuilles ayant une extrémité de déchargement de feuilles (17) ;
- une baie d'empilement (5),

dans lequel des feuilles amenées par l'appareil de

transport de feuilles à l'extrémité de déchargement de feuilles de cet appareil sont empilées ; la baie d'empilement comprenant une plateforme d'empilement (19), l'extrémité de déchargement de feuilles et la plateforme d'empilement étant animées d'un mouvement de rapprochement et d'éloignement l'une de l'autre ;

caractérisé en ce que la plateforme d'empilement supporte un transporteur de piles (25) déplaçable dans une direction parallèle la direction d'avancement des feuilles dans la baie d'empilement, configuré et commandé pour effectuer un mouvement de décalage alternatif pour former des paquets de feuilles décalés et pour effectuer en outre un mouvement d'évacuation, afin d'enlever une pile achevée de la baie d'empilement.

2. Le gerbeur de feuilles selon la revendication 1, dans lequel la plateforme d'empilement est animée d'un mouvement de soulèvement et d'abaissement verticaux par rapport à la structure de support stationnaire.
3. Le gerbeur de feuilles selon la revendication 1 ou 2, comprenant en outre une plaque de butée (37), positionnée dans la baie d'empilement au-dessus de la plateforme d'empilement, agencée et configurée pour arrêter l'apport de feuilles par l'appareil de transport de feuilles à la baie d'empilement.
4. Le gerbeur de feuilles selon la revendication 3, dans lequel la plaque de butée a un mouvement vertical alternatif qui est synchronisé avec la formation des paquets de feuilles décalés.
5. Le gerbeur de feuilles selon l'une quelconque des revendications précédentes, dans lequel l'extrémité de déchargement de feuilles de l'appareil de transport de feuilles est combinée avec un organe d'actionnement, lequel commande un mouvement de soulèvement et d'abaissement de l'extrémité de déchargement de feuilles qui est synchronisé avec le mouvement alternatif de décalage du transporteur de piles.
6. Le gerbeur de feuilles selon l'une quelconque des revendications précédentes, dans lequel le mouvement d'évacuation dudit transporteur de piles est orienté de telle sorte que la pile achevée est déplacée de la baie d'empilement vers le dessous de l'appareil de transporteur de feuilles.
7. L'empileur de feuilles selon l'une quelconque des revendications précédentes, dans lequel ledit transporteur de piles comprend un premier organe de transport de piles et un second organe de transport de piles, lesquels sont agencés en série l'une après l'autre dans une direction parallèle à la direction du

mouvement d'évacuation.

8. L'empileur de feuilles selon la revendication 7, dans lequel le premier organe de transport de piles et le second organe de transport de piles sont agencés et commandés de telle sorte qu'une pile est formée sur le premier organe de transport de piles et, après la formation de celle-ci, la pile achevée est déplacée par le premier organe de transport de piles vers le second organe de transport de piles et subséquemment par le second organe de transport de piles à l'extérieur de la baie d'empilement.
9. Le gerbeur de feuilles selon l'une quelconque des revendications précédentes, dans lequel l'extrémité de déchargement de feuilles est combinée avec un dispositif de rétention de paquets, lequel est configuré et agencé pour retenir le paquet le plus élevé de la pile lorsque le transporteur de piles effectue le mouvement de décalage dans une direction d'éloignement de l'extrémité de déchargement de feuilles.
10. Le gerbeur de feuilles selon la revendication 9, dans lequel le dispositif de rétention de paquets comprend au moins un organe élastique de freinage de feuilles, agencé sous l'extrémité de déchargement de feuilles, entre l'extrémité de déchargement de feuilles et la pile en cours de formation sur la plateforme d'empilement.
11. Un procédé de formation de piles de feuilles sur une surface d'empilement, comprenant les étapes suivantes :
 - l'avancement d'une pluralité de feuilles le long d'un appareil de transport de feuilles (3) vers une baie d'empilement (5), l'appareil de transport de feuilles ayant une extrémité de déchargement de feuilles (17), depuis laquelle les feuilles sont déchargées dans la baie d'empilement et empilées sur un transporteur de piles (25) supporté par une plateforme d'empilement (19) agencée dans la baie d'empilement ;
 - pendant que la pile de feuilles croît progressivement sur la surface d'empilement, éloignement de la plateforme d'empilement et de l'extrémité de déchargement de feuilles de l'appareil de transport de feuilles l'une de l'autre ;

caractérisé par

- durant la formation de la pile, la division de la pile en paquets de feuilles décalés et superposés les uns sur les autres en déplaçant alternativement le transporteur de piles (25) suivant le mouvement de décalage vers l'avant et l'arrière, dans une direction parallèle à la direction d'avancement des feuilles dans la baie d'empilement.

lement.

12. Le procédé selon la revendication 11, comprenant en outre l'étape d'évacuation de la pile de la baie d'empilement après achèvement de la pile, en déplaçant le transporteur de piles dans une direction d'évacuation parallèle à son mouvement de décalage. 5
13. Le procédé selon la revendication 12, dans lequel la direction d'évacuation est orientée de telle sorte que la pile formée est transférée sous l'appareil de transport de feuilles. 10
14. Le procédé selon la revendication 13, dans lequel l'étape d'éloignement de la plateforme d'empilement et de l'extrémité de déchargement de feuilles l'une de l'autre comprend l'étape d'abaissement de la plateforme d'empilement par rapport à une structure de support stationnaire. 15
20
15. Le procédé selon l'une quelconque des revendications 11 à 14, comprenant en outre l'étape de soulèvement de l'extrémité de déchargement des feuilles depuis le sommet de la pile en cours de formation sur la plateforme d'empilement lorsque la pile en cours de formation est déplacée par le transporteur de piles vers l'extrémité de déchargement de feuilles durant le mouvement de décalage vers l'avant et vers l'arrière du transporteur de piles. 25
30
16. Le procédé selon l'une quelconque des revendications 11 à 15, comprenant en outre l'étape de mise en butée des feuilles provenant de l'appareil de transport de feuilles contre une plaque de butée agencée au-dessus de la plateforme d'empilement. 35
17. Le procédé selon la revendication 16, comprenant en outre l'étape de déplacement alternatif de la plaque de butée dans une direction verticale en synchronisation avec le mouvement de décalage vers l'avant et l'arrière du transporteur de piles. 40
18. Le procédé selon l'une quelconque des revendications 11 à 17, dans lequel le transporteur de piles comprend un premier organe de transport de piles (25A) et un second organe de transport de piles (25B) agencés en série le long de la direction de déplacement du transporteur de piles ; et dans lequel : 45
50
une première pile de feuilles composée de paquets décalés est formée sur le premier organe de transport de piles ;
après son achèvement, la première pile est déplacée du premier organe de transport de piles vers le second organe de transport de piles ;
la première pile est évacuée de la baie d'empilement par le second organe de transport de piles et la formation d'une seconde pile de paquets décalés commence sur le premier organe de transport de piles.

lement par le second organe de transport de piles et la formation d'une seconde pile de paquets décalés commence sur le premier organe de transport de piles.

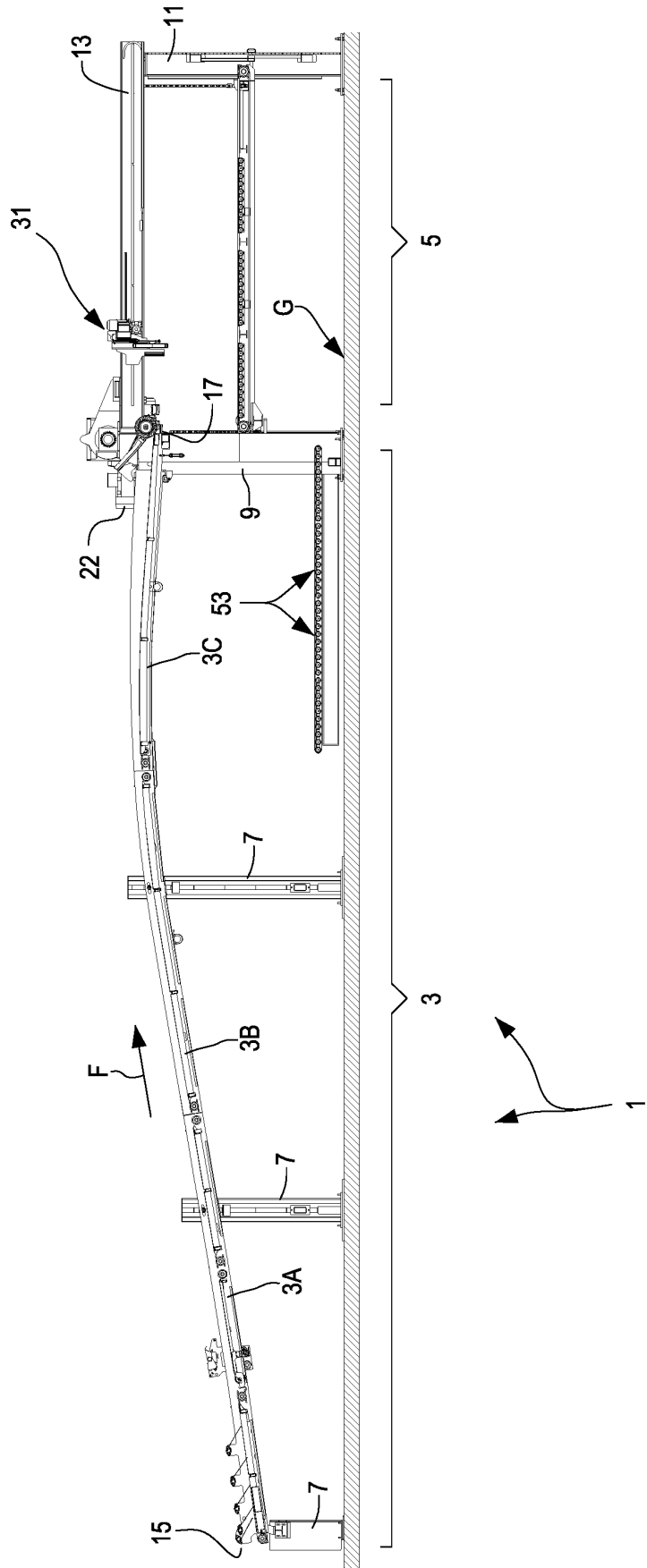


Fig.1

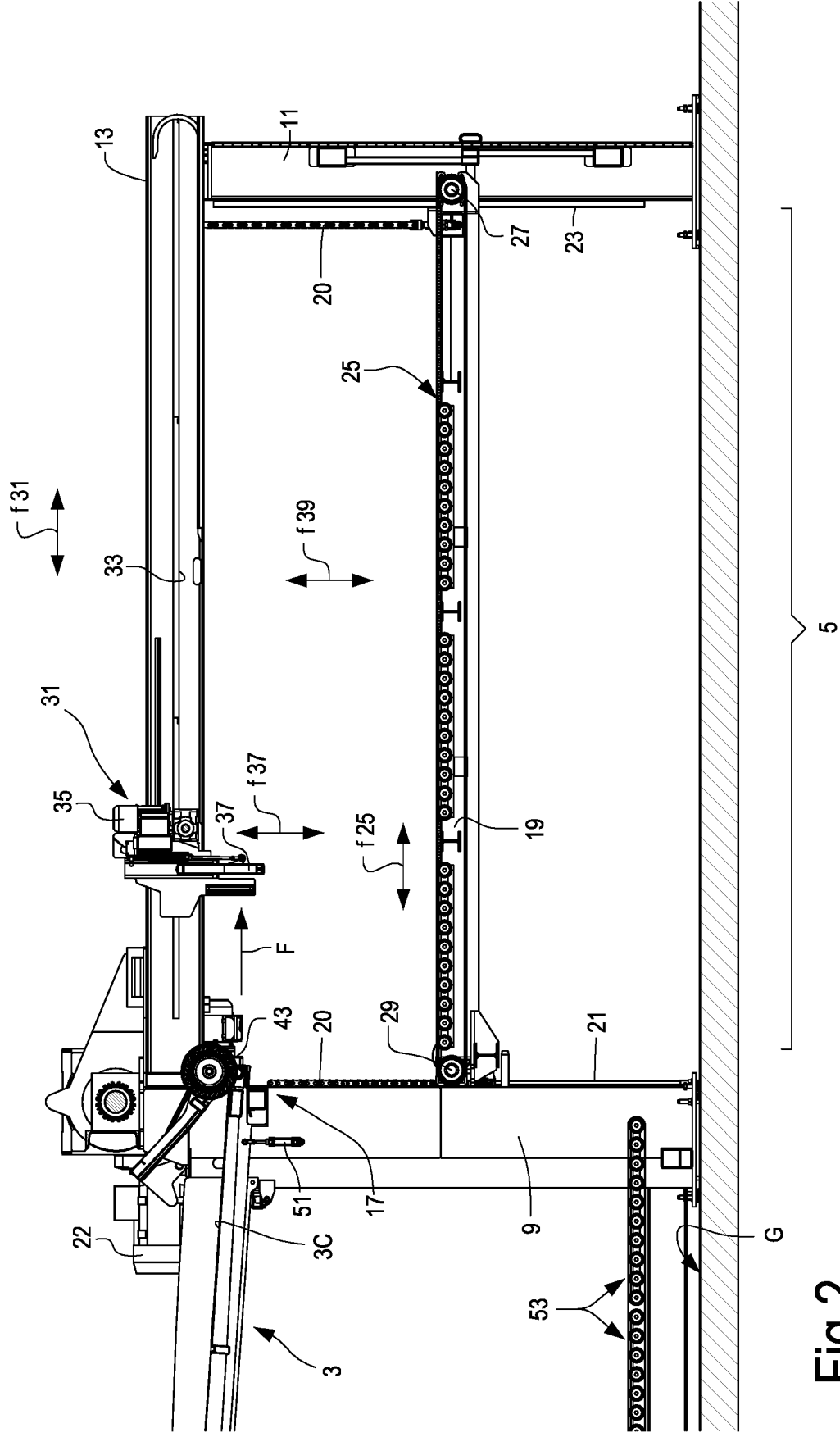


Fig.2

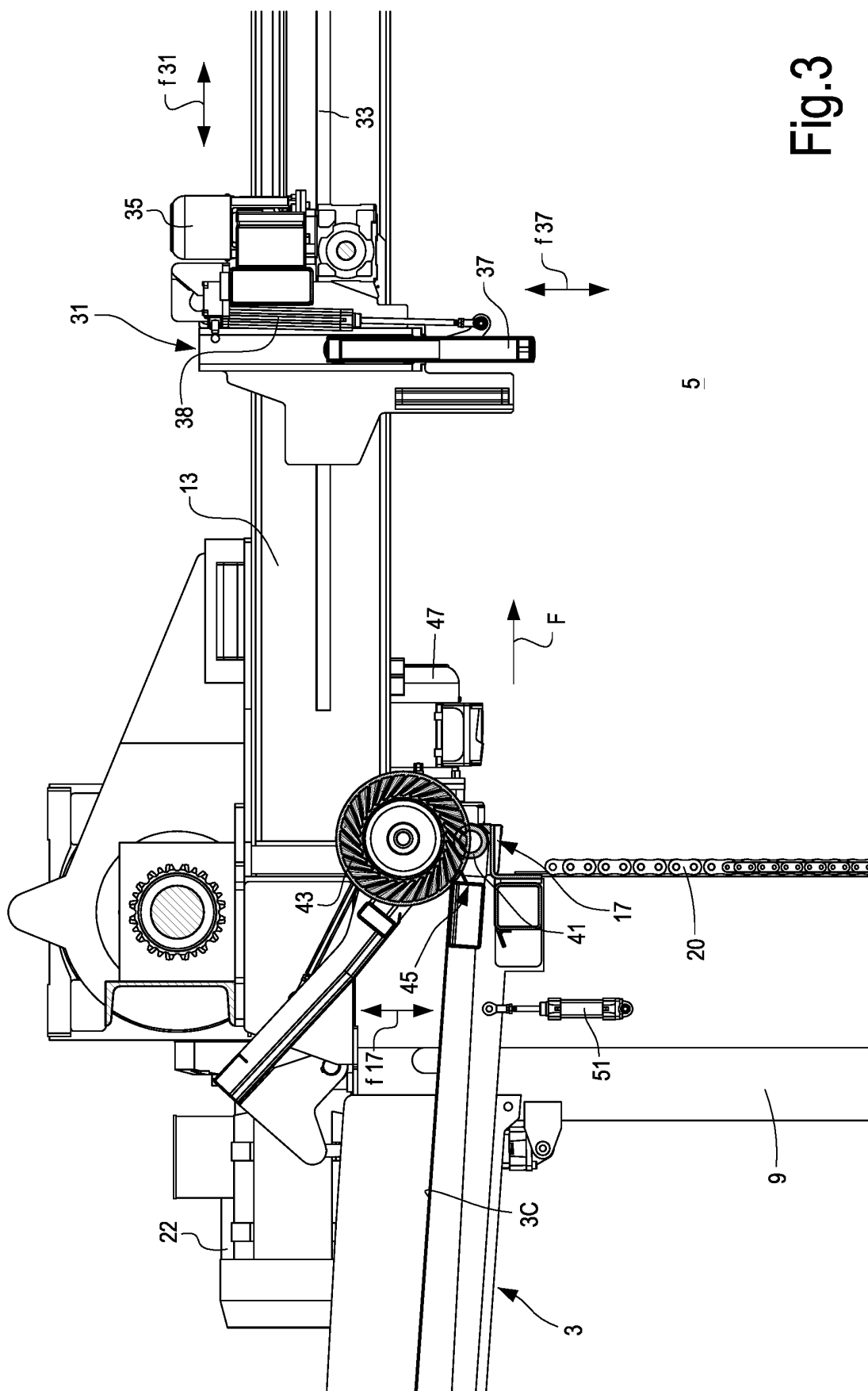


Fig. 3

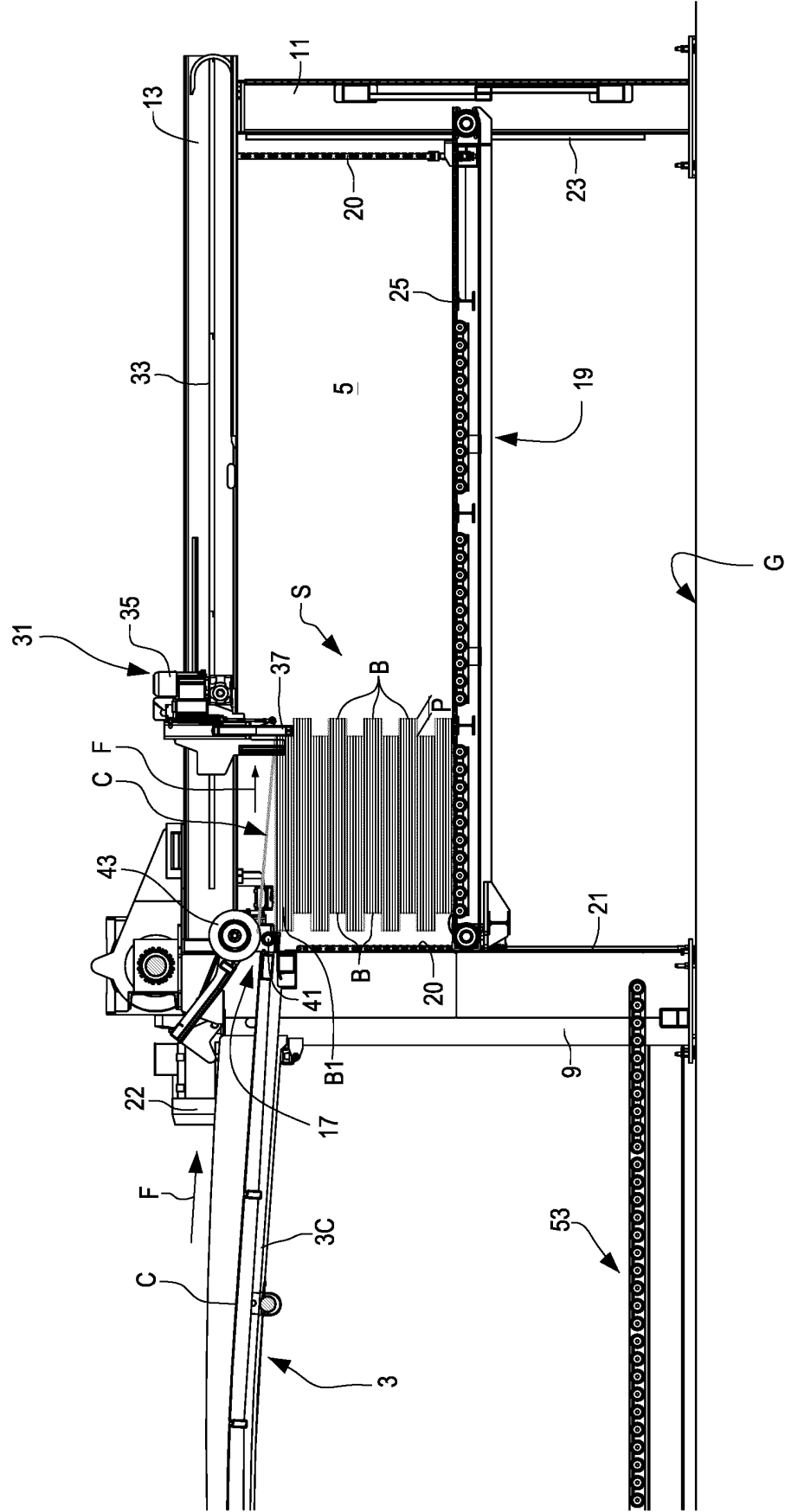


Fig. 4(A)

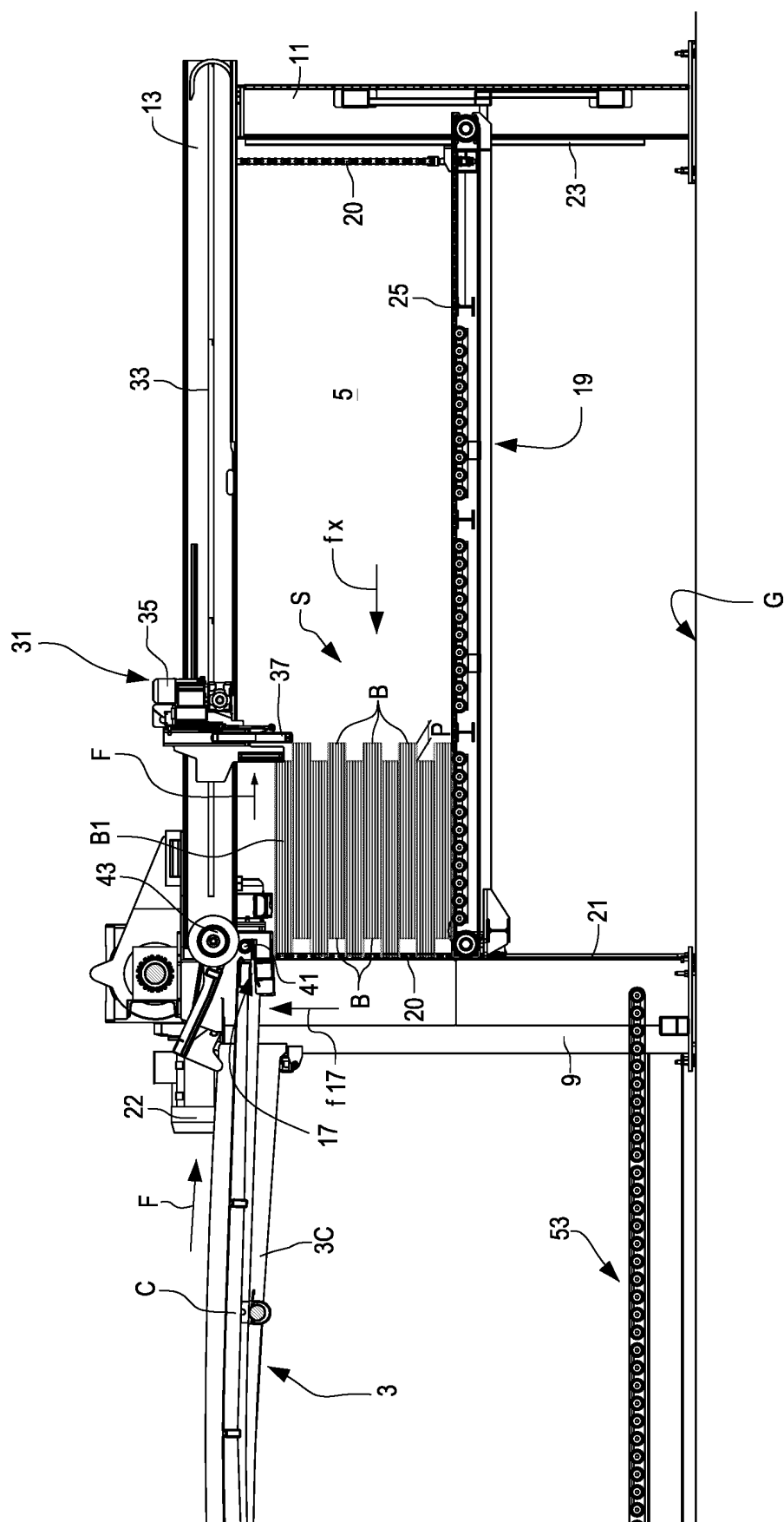


Fig. 4(B)

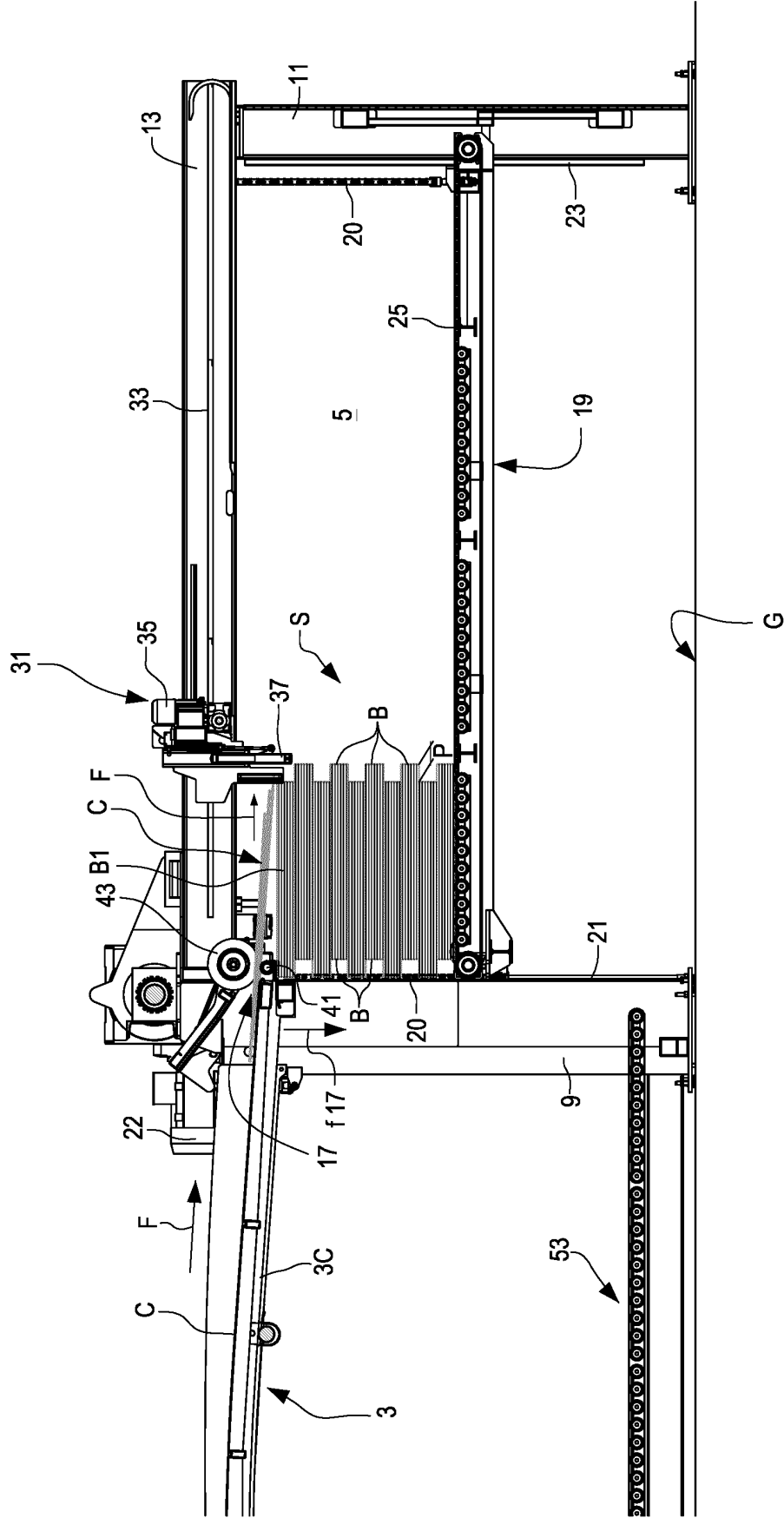


Fig. 4(C)

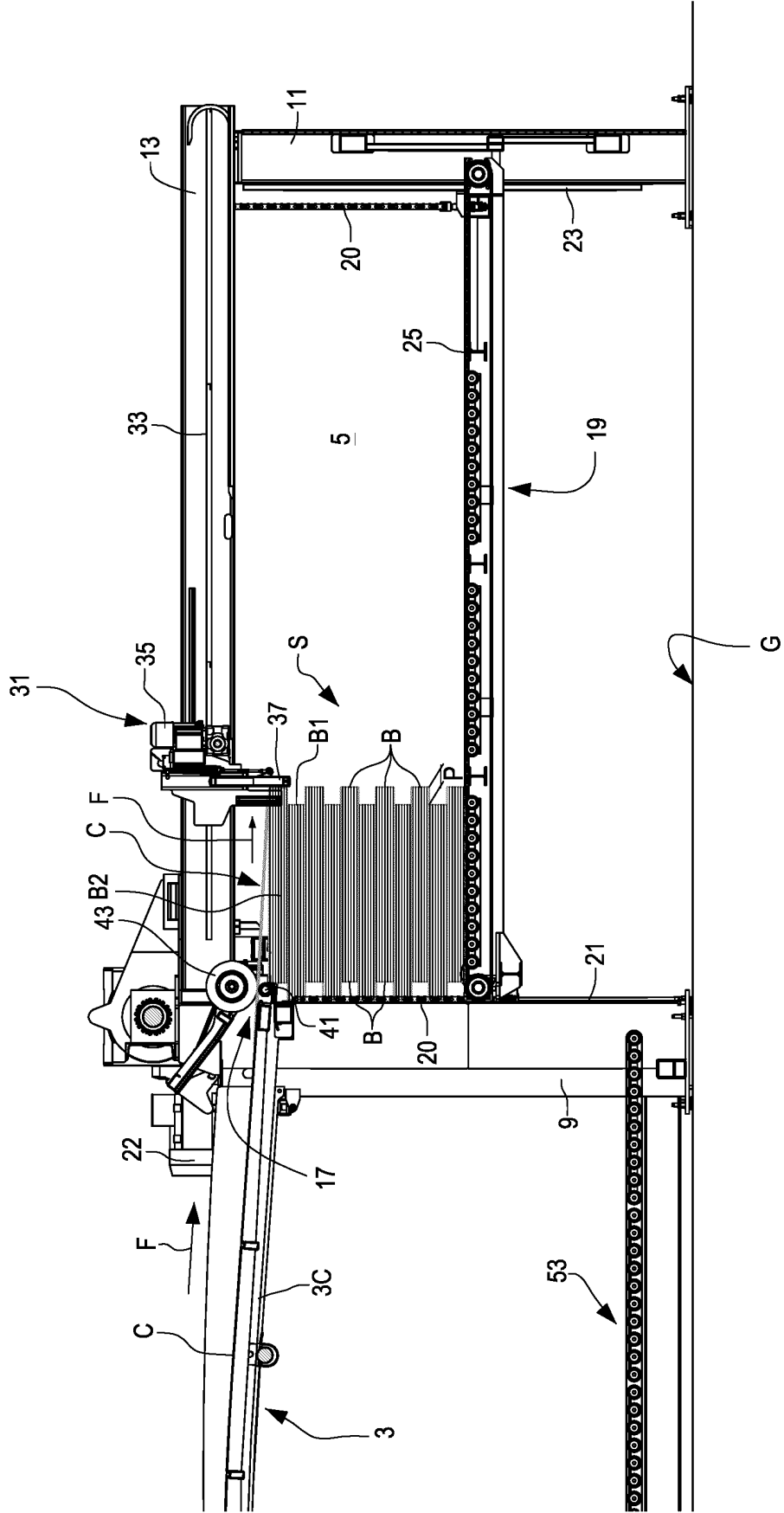


Fig. 4(D)

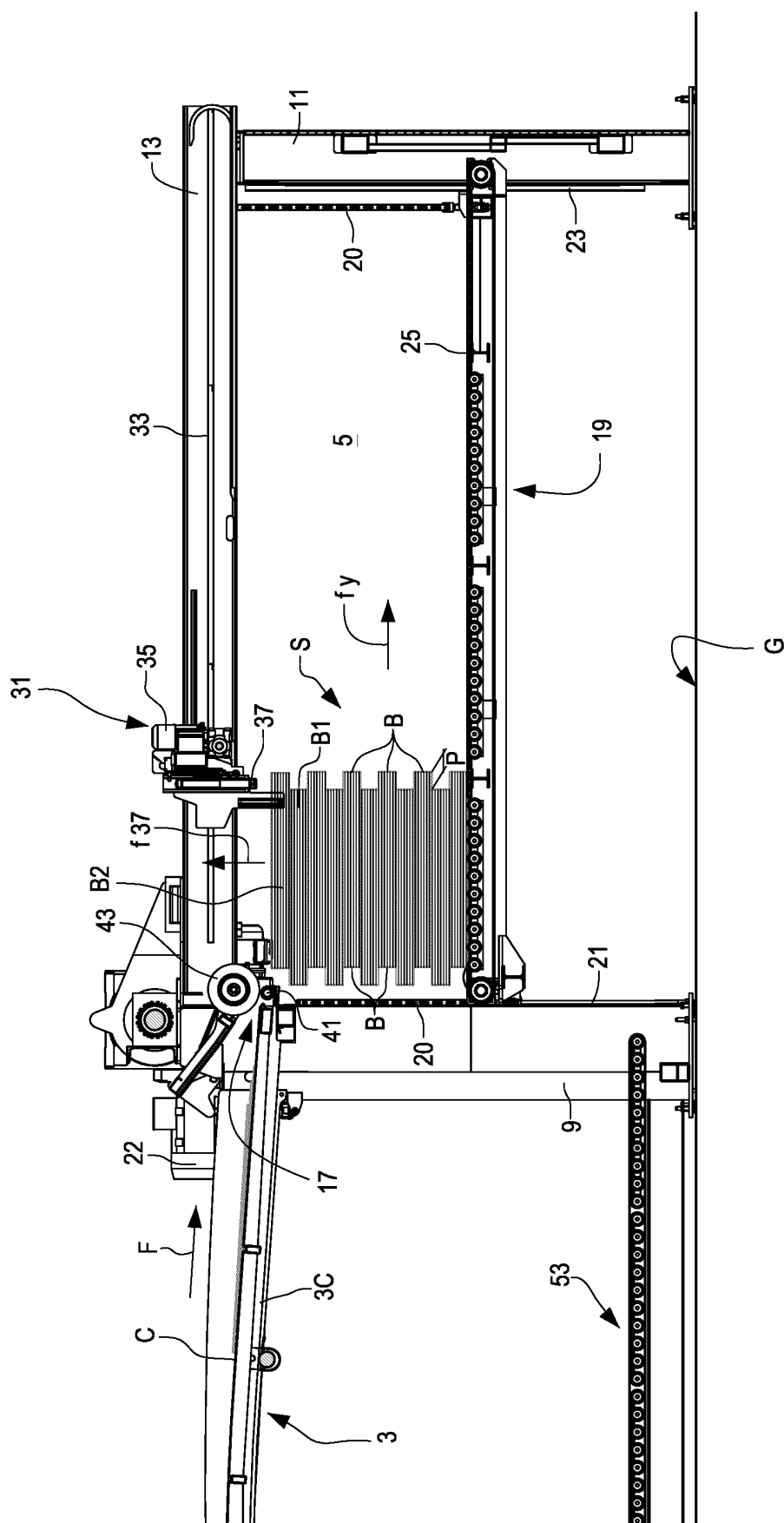


Fig. 4(E)

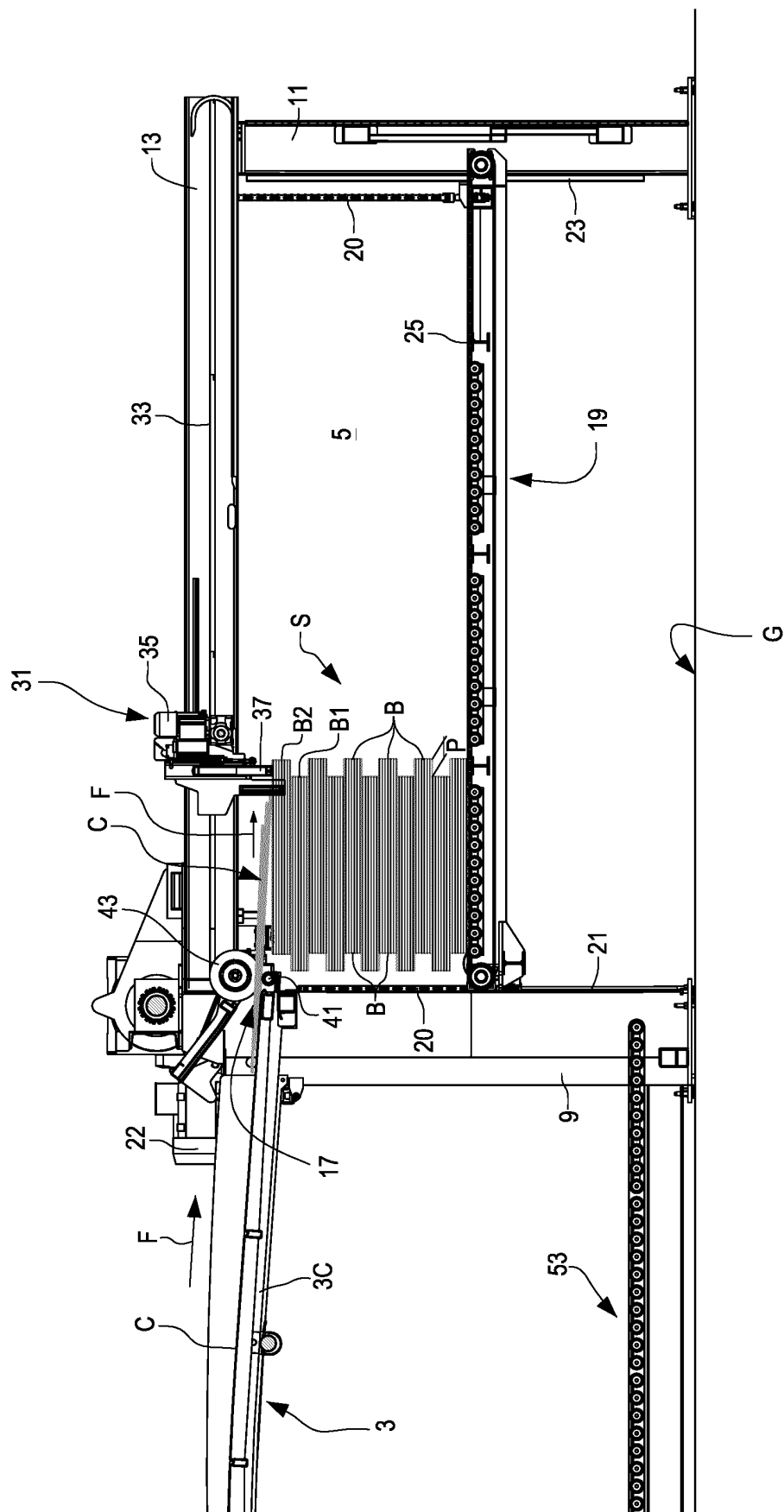


Fig.4(F)

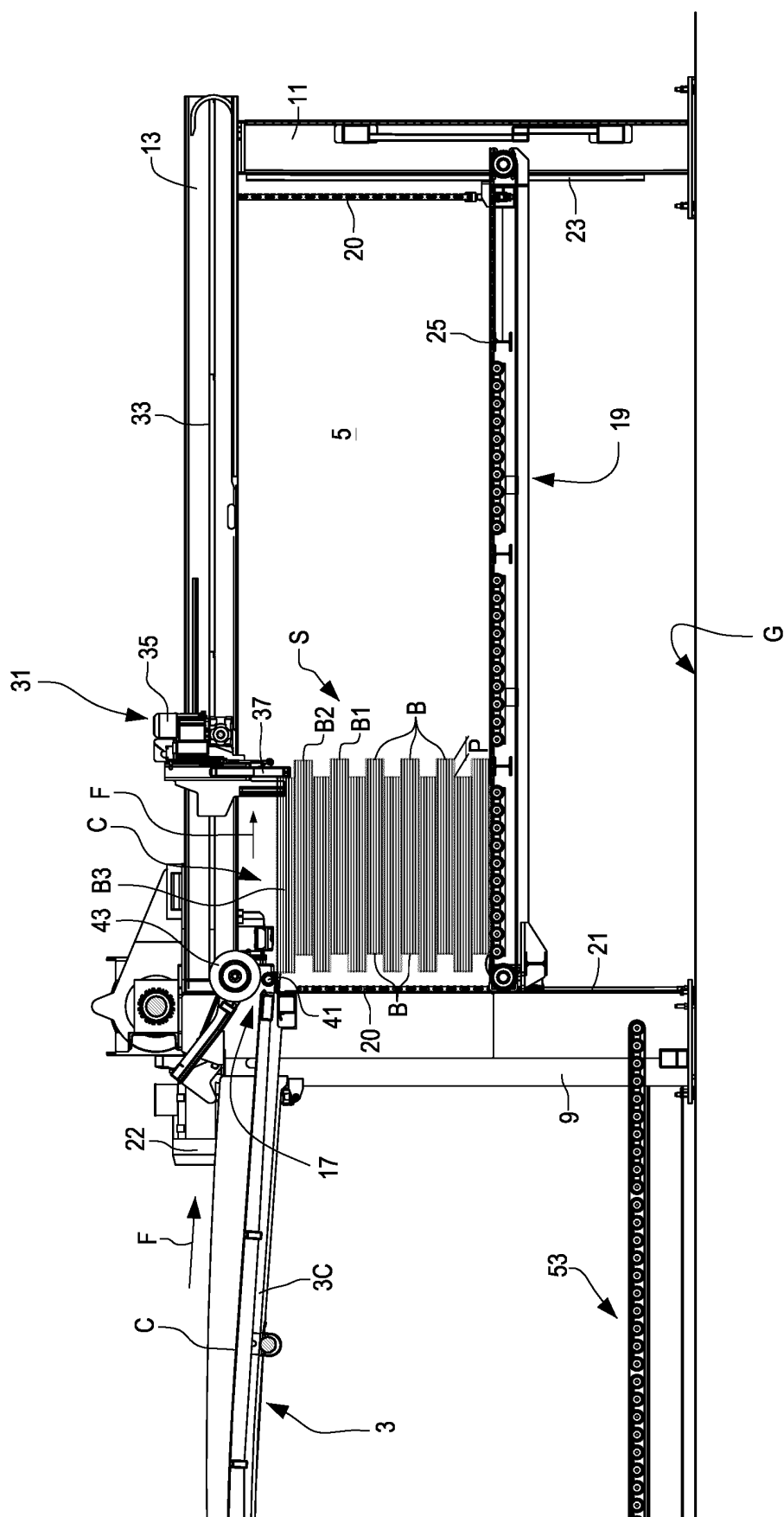


Fig. 4(G)

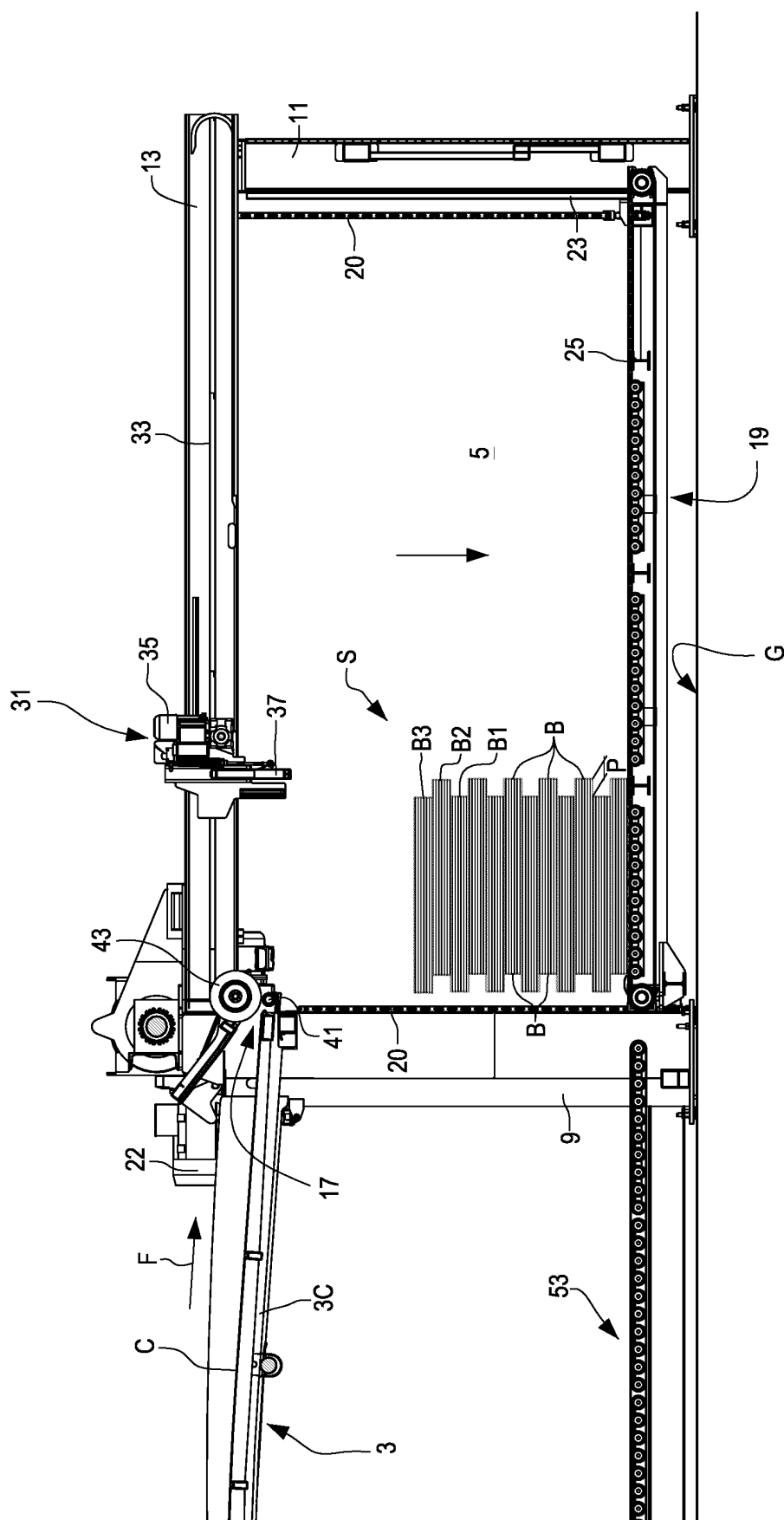


Fig. 4(H)

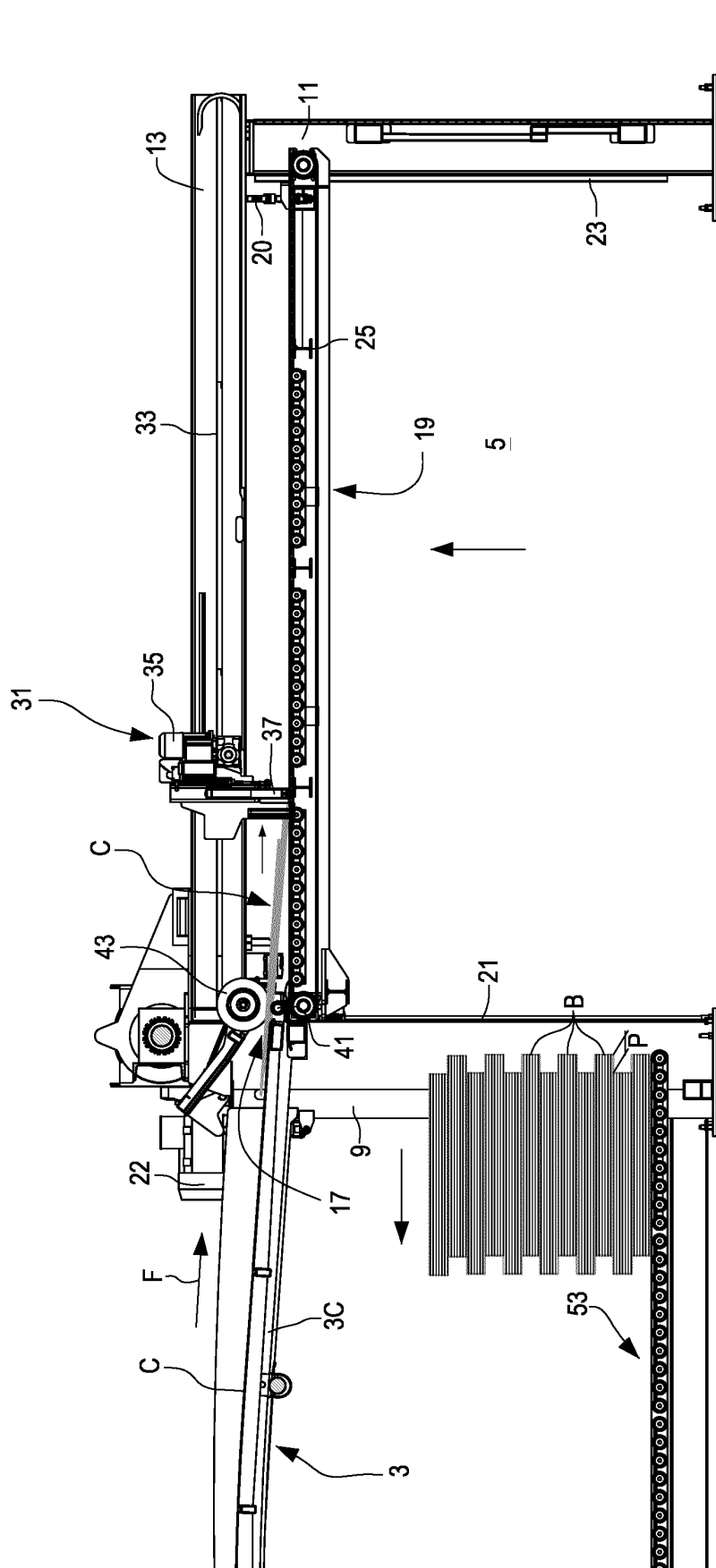


Fig. 4(I)

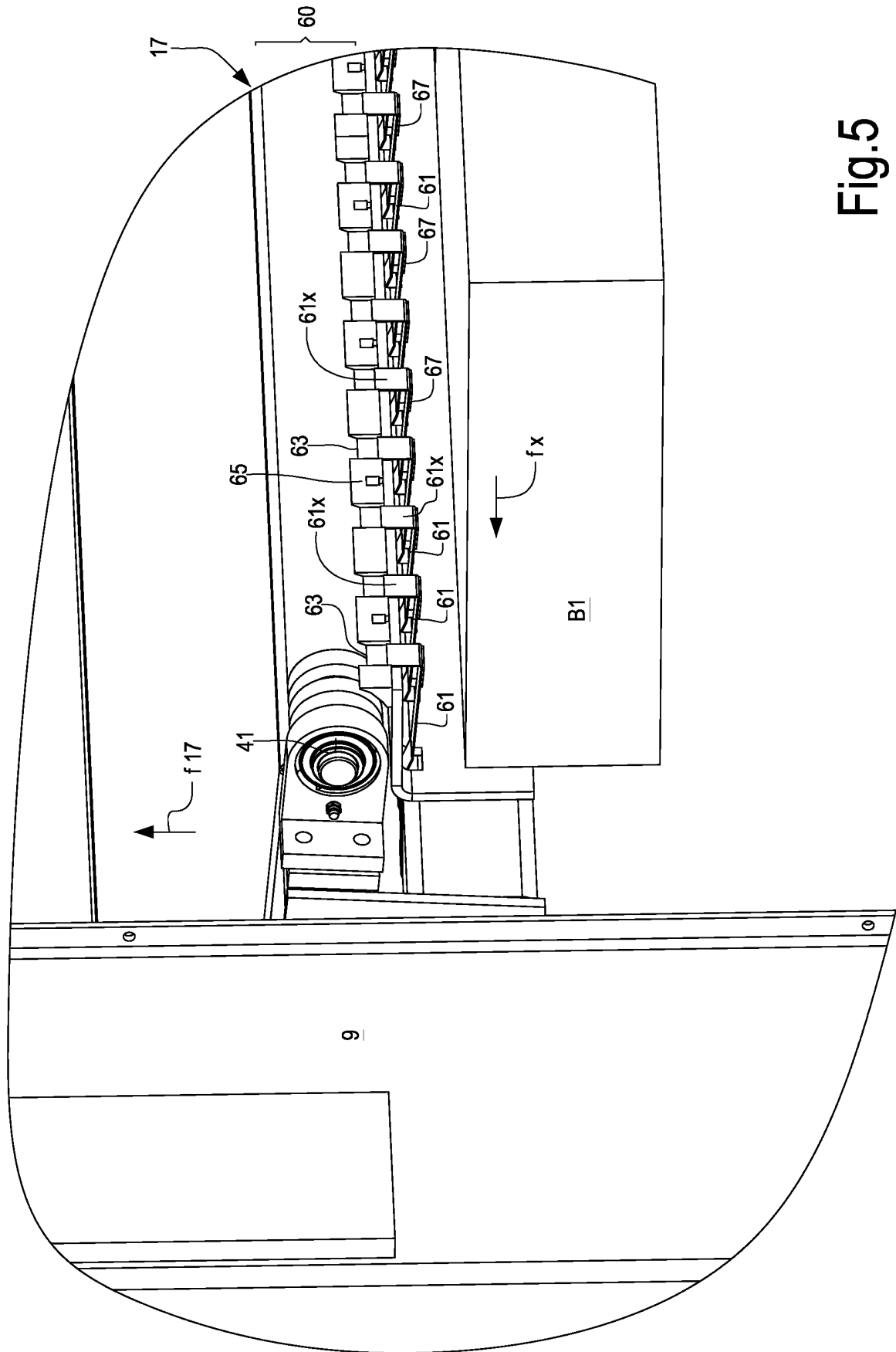


Fig.5

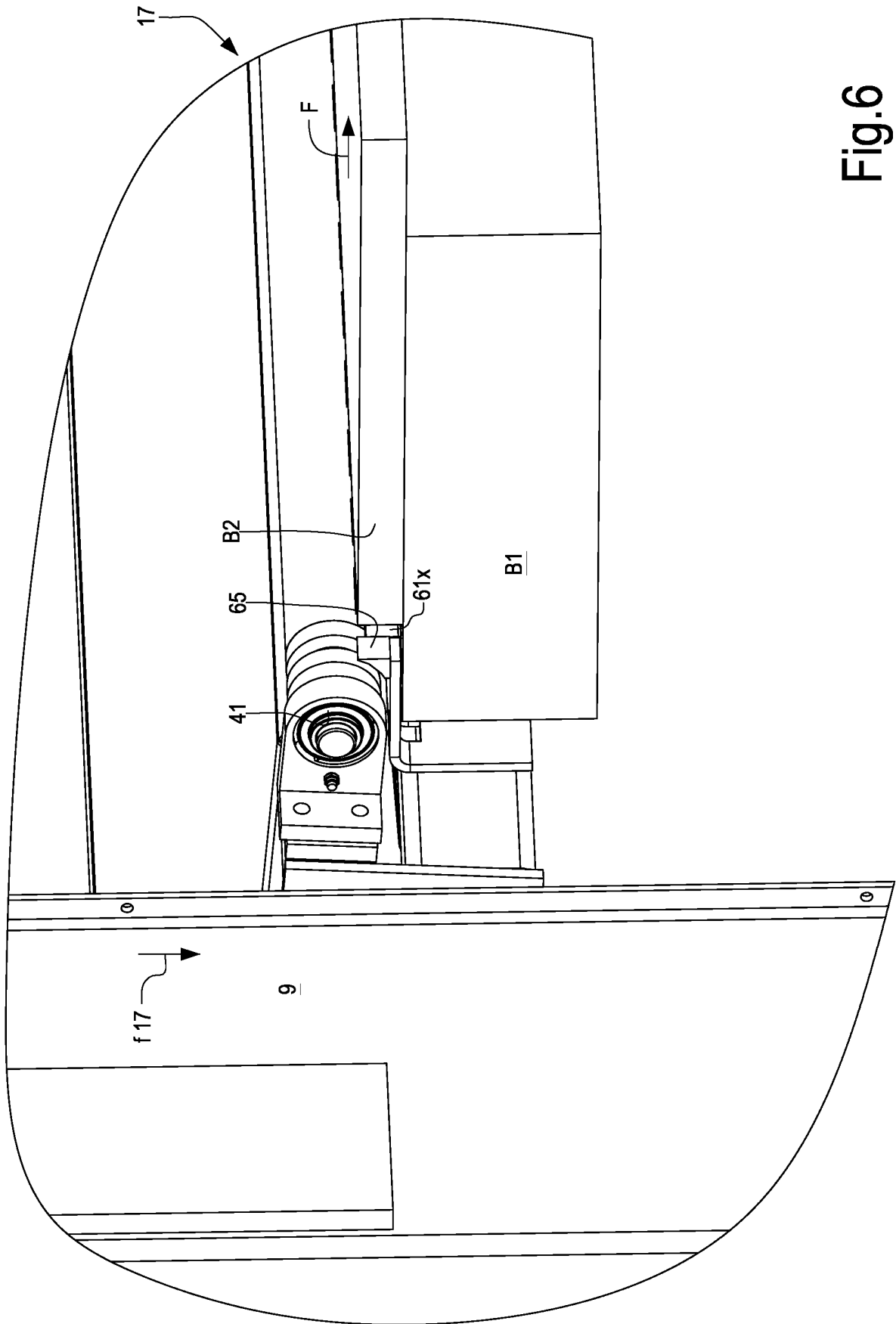


Fig. 6

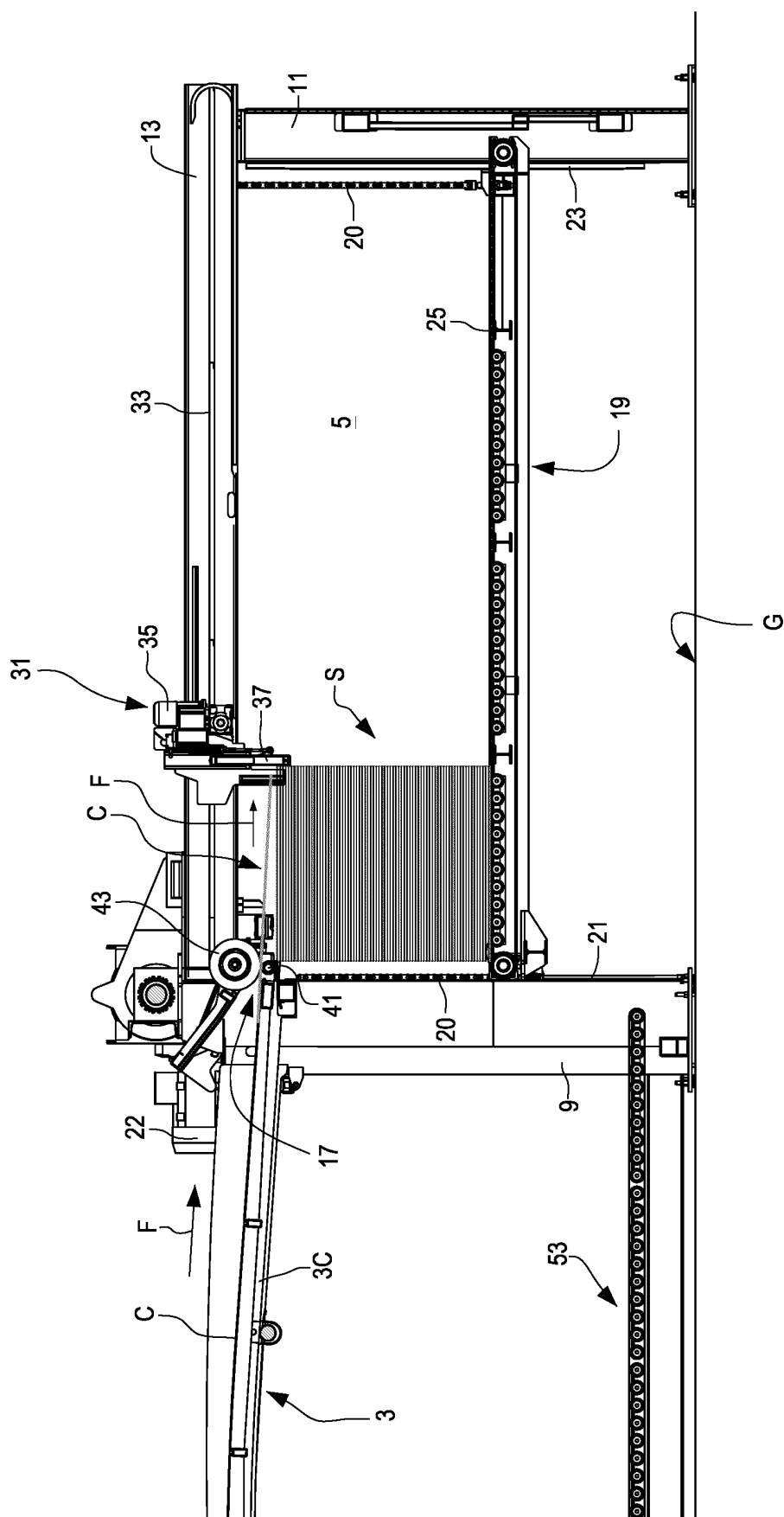


Fig. 7(A)

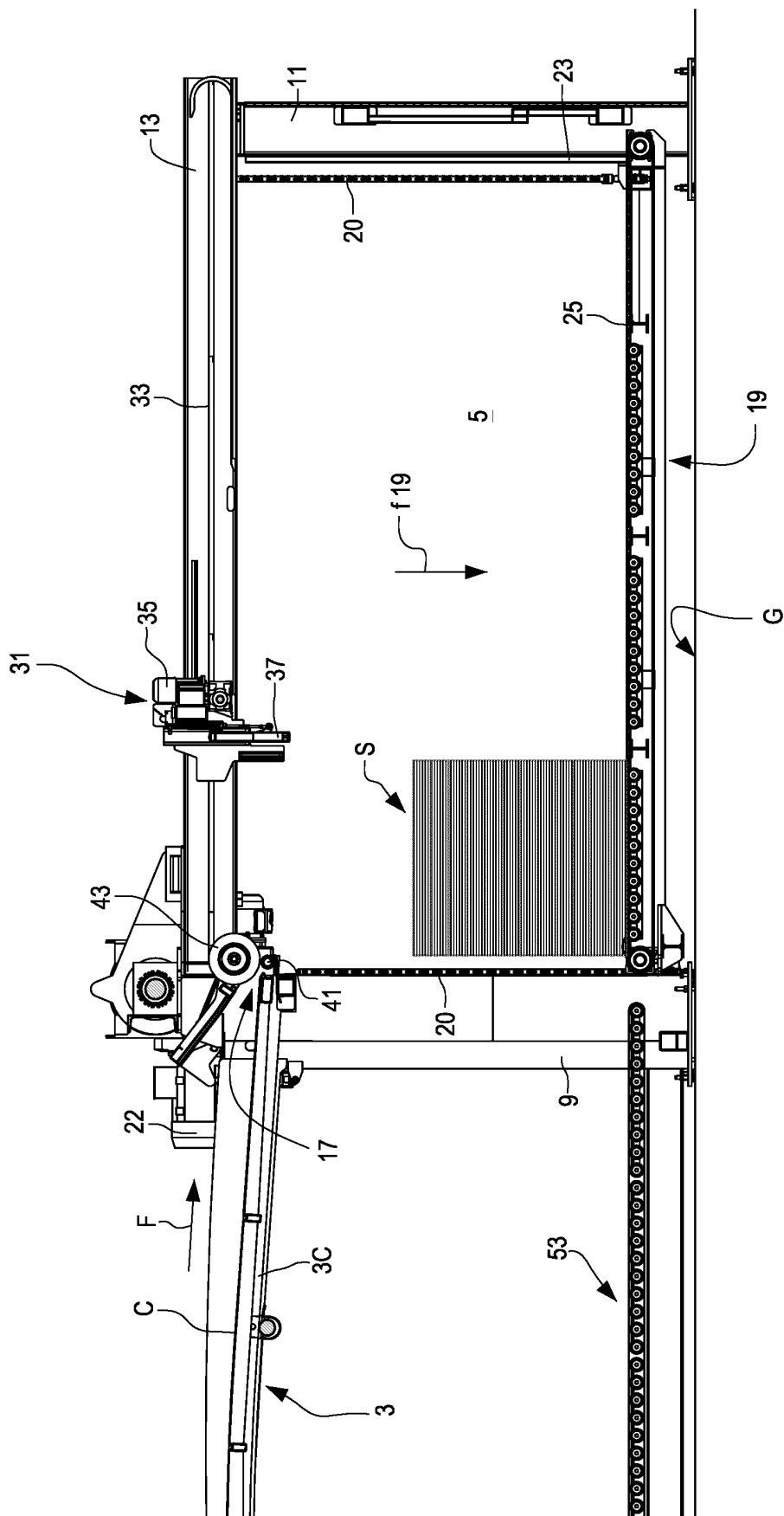


Fig. 7(B)

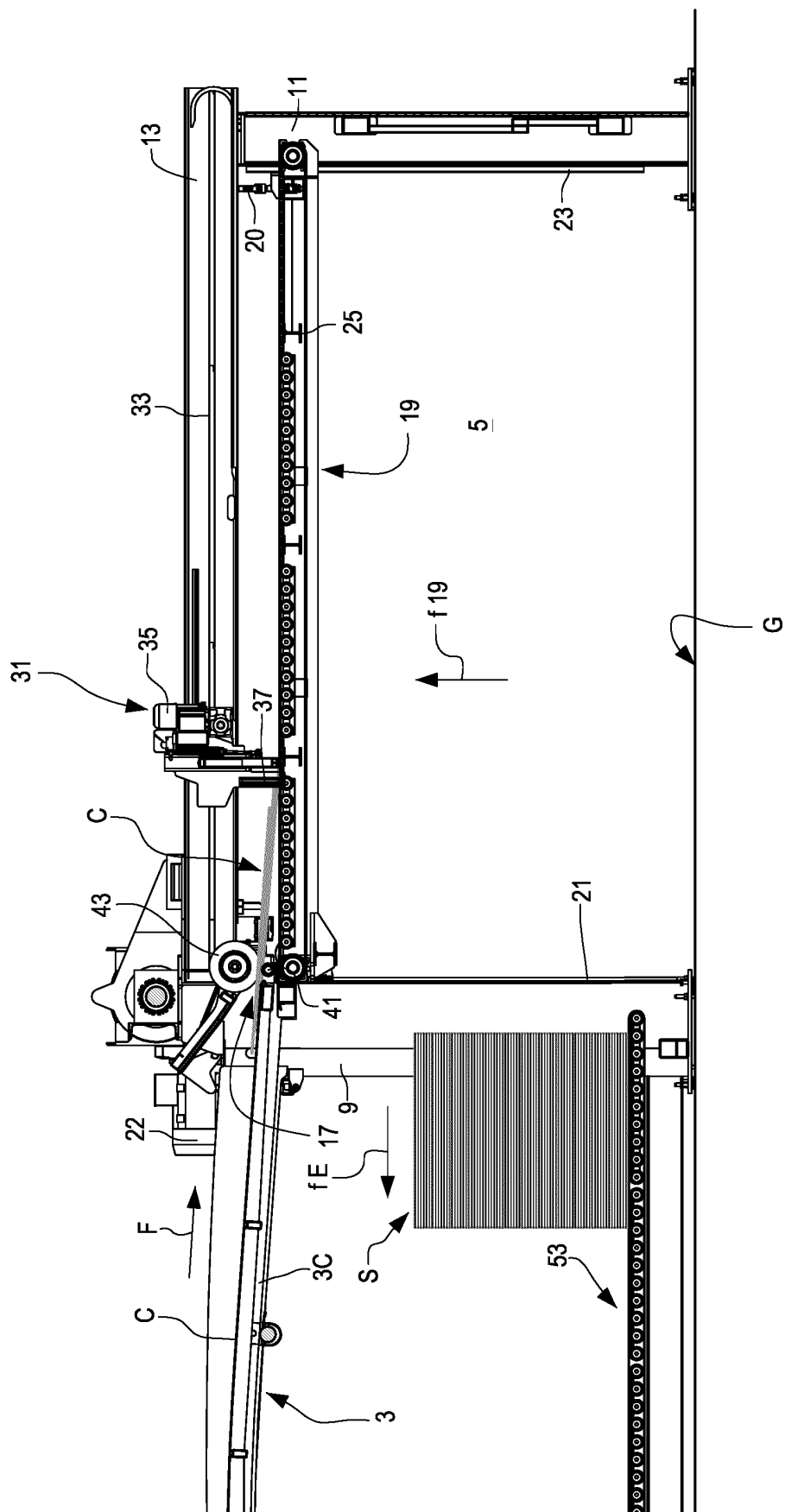


Fig. 7(C)

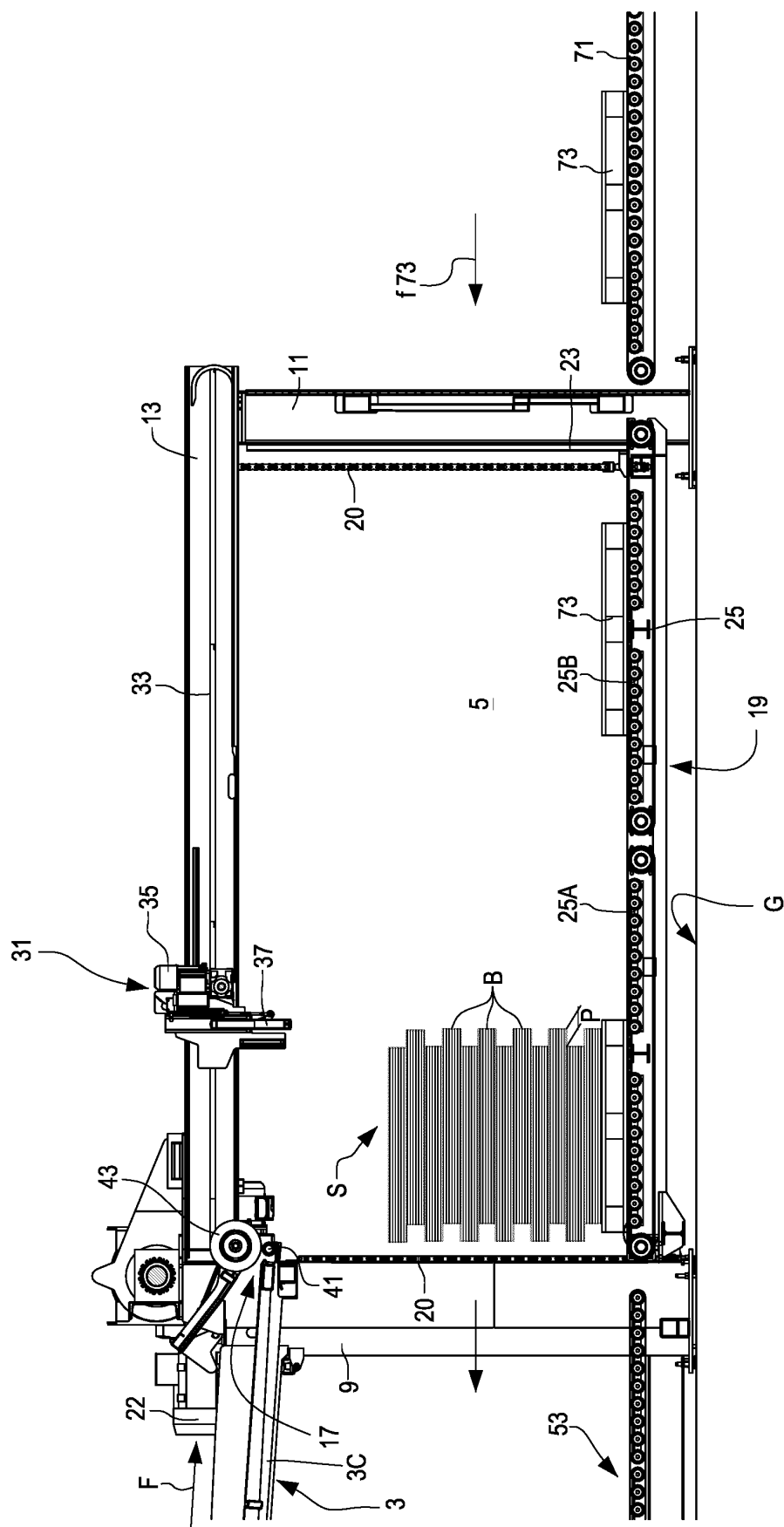


Fig. 8

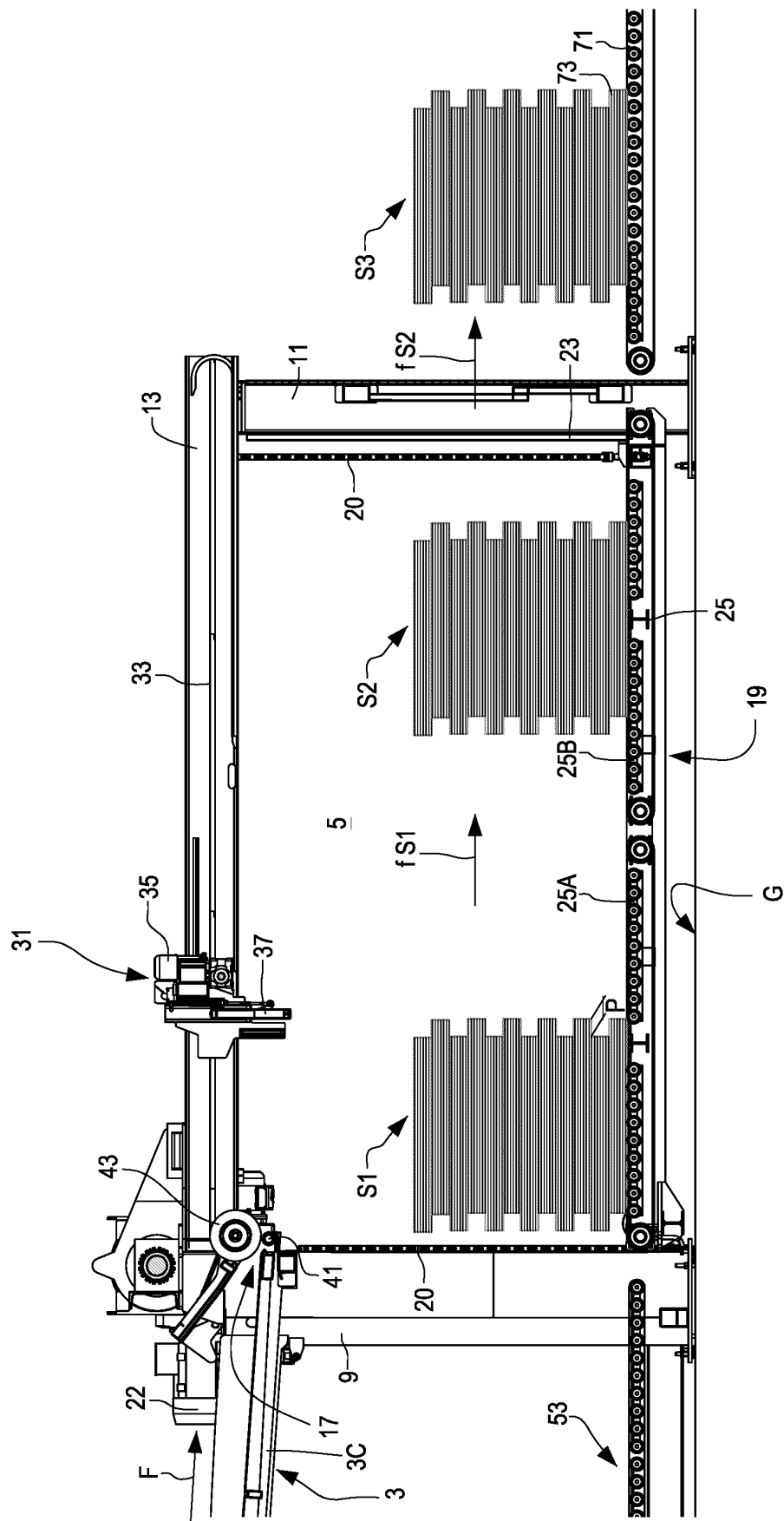


Fig.9

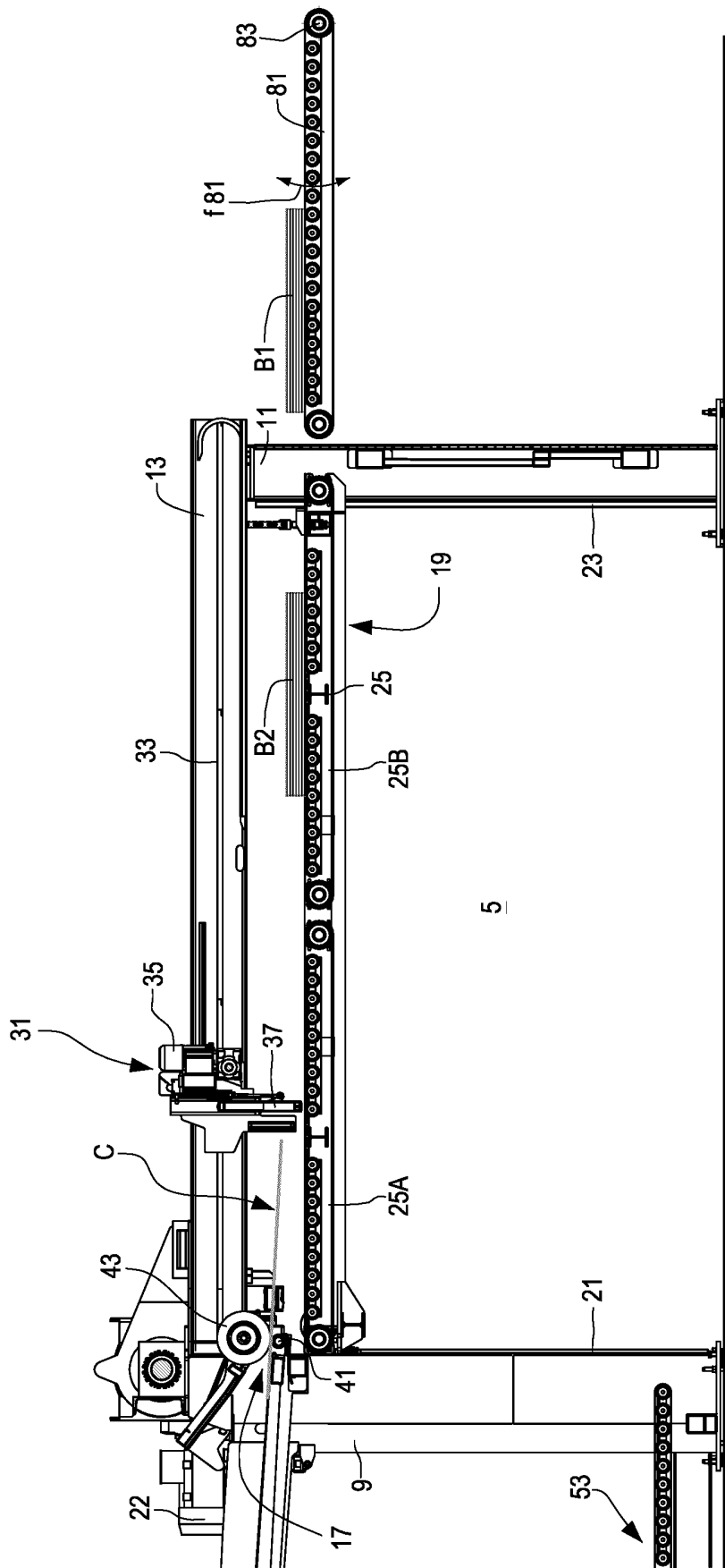


Fig.10

REFERENCES CITED IN THE DESCRIPTION

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