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

(11) **EP 3 566 956 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
13.11.2019 Bulletin 2019/46

(51) Int Cl.:
B65B 7/16 *(2006.01)* ***B65B 51/14*** *(2006.01)*
B65B 43/52 *(2006.01)*

(21) Application number: **18191937.4**

(22) Date of filing: **31.08.2018**

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

(30) Priority: **10.05.2018 IT 201800005237**

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(54) PACKAGING MACHINE FOR TRAY-PACKAGED PRODUCTS

(57) The present invention relates to the field of the automatic packaging machines for example for packaging food products and in particular a packaging machine (10) for tray-packed products comprising feeding means (110) of the closed-loop type configured to operate the forward feeding of trays along a feeding plane (FP), said feeding means (110) comprising an upper branch (112) which defines said feeding plane (FP), and a lower branch (114); welding means (210) configured to operate the welding between a heat-sealing film and a tray at a welding position, said welding means (210) comprising an upper welding bell (212) and a lower welding bell (214) which are movable to each other; moving means (310) of said lower welding bell (214) along a welding direction (WD) which is perpendicular to said feeding plane (FP) between a rest position, in which said upper welding bell (212) and said lower welding bell (214) are spaced apart from each other, to a working position, in which said upper welding bell (212) and said lower welding bell (214) are coupled to each other to operate the welding between the heat-sealing film and the tray; and is characterized in that when the upper welding bell (212) and the lower welding bell (214) are in the rest position, the moving means (310) are arranged separated from the lower welding bell (214) of a separation distance (SD) capable to allow the lower branch (114) of the feedings means (110) to move between the lower welding bell (214) and the moving means (310).

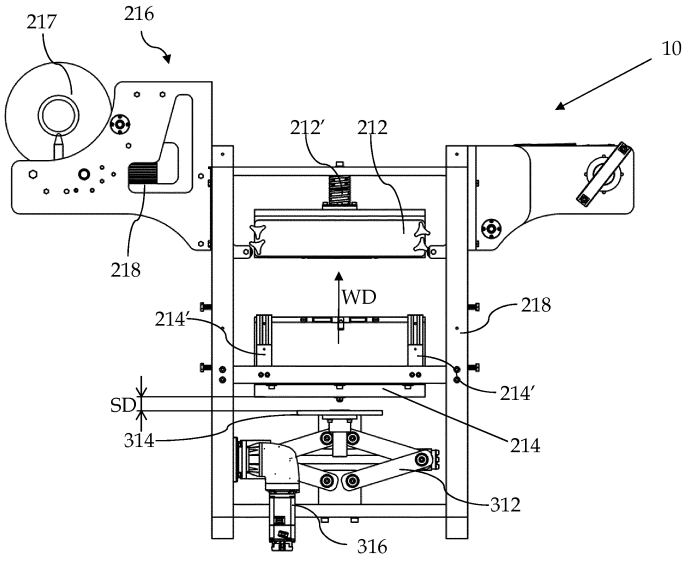


FIG. 2

EP 3 566 956 A1

Description

TECHNICAL FIELD

[0001] The present invention concerns the field of the automatic packaging machines. In particular, the present invention relates to the field of the heat-sealing machines for tray-packed products, preferably of the food type. Even more preferably, the present invention relates to the field of the modified atmosphere heat sealing machines.

[0002] Food products arranged in trays are typically packaged by means of appropriate packaging machines adapted to apply a film made of heat sealing material to the relative tray. Such packaging machines are also known as heat sealers.

[0003] The automatic packaging machines use means for feeding the trays to guarantee the supply of one or more of the aforementioned trays at the welding portion. The application of the heat-sealing film is therefore obtained by means of appropriate welding means able to couple the heat-sealing film to the perimeter portion of the tray, possibly in a modified and/or vacuum environment. The welding means generally comprise a lower welding bell, movable along a welding path and in the direction of a fixed upper welding bell to guarantee the correct coupling of the tray to the heat-sealing film.

[0004] The packaging machines of the known type are also provided with feeding means of the closed-loop type, e.g. of the chain type. These are moved along a predefined path through the use of a plurality of idle return or motorized pinions and such as to define a plurality of branches of the closed loop. In particular, the feeding means define a horizontal stretch at the tray feeding plane, which guarantees the correct maintenance of the position of the tray during movement, and a plurality of portions adapted to define an external path to the welding means, in particular external to the moving means of the movable welding bell.

[0005] To prevent interference with the movement of the movable welding bell, the path defined by the return pinions must ensure a large enough closed loop to guarantee the movement of the movable welding bell from a working position in which the fixed welding bell and the movable welding bell are coupled to each other for heat sealing the heat-sealing film to the tray, to a rest position, in which the fixed welding bell and the movable welding bell are spaced apart from each other, and vice versa.

[0006] Therefore the rest position of the movable lower welding bell defines the minimum path necessary to be realized for the feeding means, as the latter have to avoid the movement mechanism of the movable welding bell.

[0007] In the packaging machines of the known type, the path travelled by the feeding means therefore has the aforementioned horizontal stretch which is returned, through the pinions, along a further plurality of linear stretches with a variable inclination until the loop is closed again at the horizontal stretch. Inside the area defined by the loop it is possible to move the lower welding bell.

[0008] To guarantee a correct forward feeding of the trays, the feeding means have a notable extension that constitutes an excess of moving material. It follows that the necessary power for realizing the aforementioned forward feeding is high and often out of proportion with simply loading the trays to be fed. In particular, the necessary power is also proportional to the mass of the feeding means to be placed in motion, a mass which is proportional to the extension thereof.

OBJECTS AND SUMMARY OF THE INVENTION

[0009] In light of the above, the problem underpinning the present invention is that of designing a packaging machine for tray-packed products, able to minimize the drawbacks set out above.

[0010] In particular, the problem underpinning the present invention is that of realizing a packaging machine for tray-packed products that can be implemented with material saving with respect to the prior art and able to minimize production and activation costs, particularly being activatable with reduced energy consumptions.

[0011] Within the context of such problem, an object of the present invention is that of realizing a packaging machine for tray-packed products provided with feeding means of the trays characterized by a reduced mass to be moved.

[0012] A further object of the present invention is that of realizing a packaging machine for tray-packed products provided with reduced energy consumption activating means.

[0013] In accordance with a first aspect thereof, the invention therefore relates to a packaging machine for tray-packed products comprising:

- feeding means of the closed-loop type configured to operate the forward feeding of trays along a horizontal feeding plane, said feeding means comprising an upper branch which defines said feeding plane, and a lower branch;
- welding means configured to operate the welding between a heat-sealing film and a tray at a welding position, said welding means comprising an upper welding bell and a lower welding bell which are movable to each other;
- moving means of said lower welding bell along a welding direction which is perpendicular to said feeding plane between a rest position, in which said upper welding bell and said lower welding bell are spaced apart from each other, and a working position, in which said upper welding bell and said lower welding bell are coupled to each other to operate the welding between the heat-sealing film and the tray;

characterized in that, when the upper bell and the lower

welding bell are in the rest position, the moving means are arranged separated from the lower welding bell of a separation distance capable to allow the lower branch of the feeding means to move between the lower welding bell and the moving means.

[0014] Within the context of the present description and subsequent claims, the expression "working position" means the position in which the upper welding bell and the lower welding bell are coupled to each other so as to define in the same way the coupling between the heat-sealing film and the perimeter portion of the tray to be packaged. In the same way, the expression "working position" can comprise the airtight coupling between the aforesaid upper welding bell and lower welding bell for controlling the environment inside which to perform the heat-sealing.

[0015] Within the context of the present description and subsequent claims, the expression "rest position" means the position in which the upper welding bell and the lower welding bell are uncoupled from each other.

[0016] Within the context of the present description and subsequent claims, the expression "welding position" means the position in which one or more trays are arranged on the feeding plane between the two welding bells.

[0017] The Applicant has verified that thanks to the spaced apart arrangement between the moving means and the lower welding bell, it is possible to make the lower return branch of the feeding means pass into the separation space therefore preventing having to outline a long path that travels around the moving means of the lower bell. In this way it is possible to minimize the path performed by the feeding means.

[0018] This advantageously allows an optimized extension of the feeding means, the need for a lower number of return pulleys and, therefore, a reduction in the production cost of the packaging machine to be obtained, and, at the same time, a reduction in energy consumptions connected with the activation of such feeding means.

[0019] The present invention can have at least one of the preferred characteristics that follow, the latter being particularly combinable with each other as preferred in order to satisfy specific application requirements.

[0020] Preferably, the lower branch of the feeding means develops substantially parallel to the feeding plane.

[0021] Advantageously, the realization of the lower branch substantially parallel to the feeding plane along the entire extension thereof allows the extension of the feeding means to be reduced to a minimum, hence maximizing the cost reduction and consumption effects of the machine.

[0022] Preferably, the moving means are configured to eliminate the separation distance and to move the lower welding bell from the rest position to the working position.

[0023] Preferably, the feeding means and the moving means of the lower bell are configured to be operated in a synchronized fashion such that the movement of the lower branch of the feeding means between the lower welding bell and the moving means is stopped when the upper welding bell and the lower welding bell are in the working position.

[0024] Preferably, the feeding means are configured to operate a step-type feeding, wherein each tray is fed along the feeding plane and stopped at the welding position.

[0025] Even more preferably, the feeding means and the moving means of the lower bell are configured to be operated in a synchronized fashion such that the moving means start to move the lower welding bell toward the working position when the feeding means stop a tray in said welding position.

[0026] In this way it is possible to operate the feeding means and the moving means by a synchronized activation.

[0027] Preferably, the moving means comprise a rhombus linkage, wherein the minimum spacing between the vertices arranged along the welding direction defines the rest position and the maximum spacing between the vertices arranged along the welding direction defines the working position.

[0028] Preferably, the feeding means comprise one or more motors of the brushless type.

[0029] Preferably, the moving means comprise one or more motors of the brushless type.

[0030] The use of motors of the brushless type allows the management of the consumptions to be optimized reducing the size of the packaging machine. At the same time, the motors of the brushless type allow the achievement and the management of the synchronization between the feeding means and the moving means.

[0031] Preferably, the feeding means comprise at least one chain of the closed-loop type.

[0032] Even more preferably, the feeding means comprise a pair of chains arranged side by side, wherein each chain defines a closed loop.

[0033] Conveniently, according to one embodiment, the chain or the chains are provided with pushers for the forward feeding of the tray along the feeding plane.

[0034] Furthermore, the chain or the chains are optionally provided with one or more apertures to allow the passage of the moving means.

[0035] This allows the technical effect according to the present invention to be maximized as the arrangement of the moving means in the operating condition with the lower welding bell is realized minimizing the impact on the feeding means.

[0036] Preferably, the upper welding bell is of the fixed type.

[0037] More preferably, the upper welding bell of the fixed type comprises position adjustment means.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] Further characteristics and advantages of the present invention will appear more clearly from the following detailed description of the preferred embodiment, made with reference to the appended drawings.

[0039] The different features in the individual configurations can be combined with each other as preferred according to the previous description, should it be necessary to avail of the advantages resulting specifically from a particular combination.

[0040] In such drawings,

- Figure 1 is a lateral plan view of the packaging machine according to the present invention;
- Figure 2 is a lateral plan view of a portion of the packaging machine of Figure 1, illustrating in greater detail the welding means and the relative moving means;
- Figure 3 is a detailed perspective view from the bottom upwards of the moving means of the packaging machine of Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

[0041] In the following description, for the illustration of the figures, identical numbers or reference symbols are used to indicate construction elements with the same function. Further, for illustration clarity, some references may not be repeated in all the figures.

[0042] While the invention is susceptible to various modifications and alternative constructions, some preferred embodiments are shown in the drawings and will be described in detail herein below. However, it is to be understood that there is no intention to limit the invention to the specific embodiment illustrated but, on the contrary, the invention intends to cover all the modifications, alternative and equivalent constructions that fall within the context of the invention as defined in the claims.

[0043] The use of "e.g.", "etc.", "or" indicates non-exclusive alternatives without limitations unless otherwise indicated. The use of "comprises" and "includes" means "comprises or includes but not limited to" unless otherwise indicated.

[0044] Indications such as "vertical" and "horizontal", "upper" and "lower" (in the absence of other indications) are to be read with reference to the assembly (or operating) conditions and with reference to the normal terminology used in current language, where "vertical" indicates a substantially parallel direction to that of the gravitational force vector "g" and horizontal to a direction perpendicular thereto.

[0045] With reference to Figure 1, a first embodiment of a packaging machine for tray-packed products is illustrated, or heat sealer indicated overall by number 10. Figure 1 illustrates a lateral plan view of the packaging machine 10 according to the present invention, in a schematic representation related only to the significant components for understanding the invention.

[0046] In particular, reference will be made below to an automatic packaging machine able to package the tray through the application of a heat-sealing film, of the known type, in a modified environment, e.g. through nitrogen, and/or vacuum.

[0047] In the main components, described in more detail below, the packaging machine 10 according to the present invention comprises feeding means 110 of the trays, welding means 210 of the heat-sealing film to the aforesaid trays, and appropriate means 310 for moving the welding means 210 as described below in greater detail.

[0048] As illustrated in Figure 1, the feeding means 110 of the trays comprise a system of the closed-loop type, i.e. such as to define an upper branch 112 and a lower branch 114 that are parallel.

[0049] The upper branch 112 of the feeding means 110 defines, in particular, the feeding plane FP of the trays themselves, while the corresponding lower branch 114 defines the return plane, i.e. the plane in which the branch is obviously free from trays for packaging.

[0050] In the embodiment illustrated, the feeding means 110 are realized through a pair of chains arranged side by side, wherein each chain defines a closed loop, i.e. each of the chains defines a respective upper branch 112 and lower branch 114.

[0051] In particular, the pair of upper branches 112 defines the feeding plane FP while the pair of lower branches 114 defines the return plane. In Figure 1 only one of the two chains is visible according to the type of lateral plan view to which reference is made.

[0052] Furthermore, the chains are provided with pushers (not illustrated) for feeding the trays along the feeding plane FP. They may be realized through elongated elements that transversally connect the branches of the two chains in a perpendicular direction to the development of the branches themselves. In the same and completely equivalent way, the pushers may be realized through elements protruding from the branches of the feeding means able to define an abutment element for feeding the trays.

[0053] The chains defining the feeding means 110 according to the present invention are also provided with a plurality of apertures to allow the passage of the moving means 310. Such apertures can be realized by way of example by appropriate chain links having a conformation such as to allow the passage of the moving means 310 or by particular conformations of the chains themselves.

[0054] According to further embodiments, not illustrated, the feeding means may comprise a single chain of the closed-loop type or be defined by a system of the closed-loop type different from the chain. Furthermore, the chain or the different system of the closed-loop type may also not comprise pushers for the trays.

[0055] The feeding plane FP and the return plane are respectively arranged on a horizontal plane, as well as being parallel, able to ensure the maintenance of the correct feeding position of the trays, in particular when already provided with the content to be packaged.

[0056] The distancing of the upper 112 and lower 114 branches of each chain is defined by the plurality of return pinions 116, at least one of which is motorized, i.e. provided with motor activation, and the remaining three idle ones, or conduits.

[0057] The motorized return pinion 118 is coupled to the motor 119 which, in the embodiment described, is of the brushless type. The motor of the brushless type, of the direct current electrical type, allows extremely precise control to be obtained, both of the speed and the acceleration thanks to the low rotor inertia. Furthermore, through the motor of the brushless type, reduced system dimensions and reduced energy consumption are ensured, associated with the activation of the feeding means 110.

[0058] The movement of the feeding means 110, i.e. of the relative chains, defines a step type movement along a feeding direction FD, i.e. in the direction of the welding means 210.

[0059] For that purpose, the use of motors of the brushless type enables the management of the movement to be optimized so as to obtain the most suitable movement method for the packaging requirements. The step-type movement, in the embodiment described, is such that the tray is fed along the feeding plane FP by a step such as to stop each tray arranged in sequence in the welding position, i.e. at the welding means 210, described in further detail below.

[0060] The feeding means 110 are, therefore, operatively connected to appropriate welding means 210 of a heat-sealing film to the trays. In this way, while the feeding means 110 allow the correct movement of the trays to be packaged to be obtained, the welding means 210 ensure that the packaging takes place as desired.

[0061] As illustrated in Figure 2, the welding means 210 comprise two welding bells adapted to allow mutual coupling for the definition of a welding station. In particular, in the embodiment described the welding means 210 comprise an upper welding bell 212 of the fixed type, arranged in the upper portion of the packaging machine 10, and a lower welding bell 214 of the movable type, arranged in the lower portion of the packaging machine 10.

[0062] To enable the mutual coupling, the two bells 212, 214 are arranged aligned along a vertical axis, perpendicular to the feeding direction FD or to the feeding plane FP, and coupled to the support structure 218 itself so that the respective perimeter edges can fit together and define the welding station.

[0063] The upper welding bell 212 is preferably coupled to the support structure 218 through a spacing device 212' able to modify the positioning of the upper welding bell 212 along the vertical axis. The spacing device 212' itself can also be provided with elastic means, e.g. a preloaded spring, able to guarantee the opposition of a resistant force during the coupling of the two bells 212, 214.

[0064] At the upper welding bell 212, the packaging machine 10 is provided with an apparatus 216 for unwinding the reel of heat-sealing film. In the embodiment described, this comprises a device 217 for supporting the reel of heat-sealing film, activated by an unwinding motor 218 configured to guarantee the supply of heat-sealing film between the two upper 212 and lower 214 welding bells. The unwinding apparatus 216 is completed by a device 219 for holding the film unwound from the reel which ensures its correct maintenance in position.

[0065] The lower welding bell 214 is preferably coupled to the support structure 218 through a plurality of guides 214' able to ensure the movement along the vertical axis and, at the same time, maintain the constraint with respect to the other two degrees of freedom.

[0066] In the embodiment illustrated, the lower welding bell 214 is the portion of the welding station configured to house the tray, or the trays, to be packaged. For that purpose, the lower welding bell 214 can be provided with appropriate seats (not illustrated) configured to house the tray or the trays to be packaged.

[0067] Furthermore, the lower welding bell 214 is the portion of the welding station intended to create the vacuum or to define the modified environment within which to realize the packaging. This therefore makes it possible to guarantee that the film of heat-sealing material unwound through the unwinding apparatus 216 adheres correctly to the perimeter edges of the tray to be packaged, ensuring the correct heat sealing.

[0068] The movement of the lower welding bell 214 is obtained through the moving means 310, illustrated in Figure 1 and in more detail in Figure 2. These allow the lower welding bell 214 to be moved along a welding direction WD which is perpendicular to the feeding plane FP, i.e. perpendicular to the feeding direction FD.

[0069] In the embodiment illustrated, the moving means 310 comprise a leverage able to ensure the movement of the lower welding bell 214 along the welding direction WD. In particular, the leverage is realized through a rhombus linkage 312, operatively connected to an electrical activation 316, preferably also of the brushless type.

[0070] The moving means 310 are finally completed by a moving plate 314 able to be operatively coupled with the lower welding bell 214 when the leverage is activated along the welding direction WD.

[0071] Obviously, the moving means 310 can also be realized by means of different leverages or using different arrangements or elements instead of the rhombus linkage, like the moving plate.

[0072] The moving means 310 are separated from the lower welding bell 214 of a separation distance SD capable to allow the lower branch 114 of the feeding means 110 to move between the lower welding bell 214 and the moving means 310, when the latter feed the tray along

the feeding plane FP. Such separation distance SD is variable according to the sizing of the packaging machine 10 and the relative chains or different feeding means 110 used.

[0073] In any case, the technical effect of the present invention is ensured by the possibility to move the lower branch 114 of the feeding means 110 between the lower welding bell 214 and the moving means 310, when the lower welding bell 214 is not in the working position.

[0074] For that purpose, the moving means 310 allow the displacement of the lower welding bell 214, along the respective guides 214', from a rest position, in which the upper welding bell 212 and the lower welding bell 214 are spaced apart from each other, and a working position in which the upper welding bell 212 and the lower welding bell 214 are coupled to each other, and vice versa.

[0075] When the lower welding bell 214 is brought into its working position, the feeding means 110 are stopped. In particular, the moving means 310 and the feeding means 110 are synchronized in such a way that the moving means 310 bring the lower welding bell 214 into the working position when the feeding means 110 stop the tray in the welding position.

[0076] Therefore, the minimum spacing between the vertices of the rhombus linkage 312 arranged along the welding direction WD defines the rest position, while the maximum spacing between the vertices themselves arranged along the welding direction WD defines the working position.

[0077] The moving means 310, or the leverage constituted by the rhombus linkage 212 activated by the motor of the brushless type 316, are configured to be operatively connected to the lower welding bell 214, coupling thereto the relative moving plate 314 that allows the thrust to be transmitted from the leverage to the lower welding bell 214 itself.

[0078] The aforesaid operating coupling therefore allows the movement of the lower welding bell 214 into the working position, eliminating the separation distance SD. In that case, the plurality of apertures provided on the chains of the moving means 110 allow the passage of the moving means themselves 310, i.e. of the moving plate 314, allowing the separation distance SD to be eliminated, as well as obtaining the technical effect according to the present invention.

[0079] The use of a packaging machine 10 according to the present invention is described below, by way of example.

[0080] Three trays to be packaged aligned in sequence on the feeding plane FP along the feeding direction FD are hypothesized. The motor 119 of the brushless type, comprised in the feeding means 110 allows the movement of the chains, and of the relative pushers, along the feeding direction FD according to a method described above as a step-type method.

[0081] Such movement is such as to feed the three trays and to stop the forward feeding when the first of the three trays is arranged at the welding position, i.e. at the lower welding bell 214.

[0082] The movement of the step-type feeding means 110 and the movement of the moving means 310 between the rest position and the welding position are synchronized in such a way as to interrupt the movement of the feeding means 10 when the moving means 310 are in the working position.

[0083] At the same time, during the movement of the feeding means 10 the lower welding bell 214 is completely uncoupled from the moving means 310 capable to allow the passage of the lower branch 114, substantially reducing the electrical consumptions.

[0084] The arrangement of the feeding means 110 and the operating connection with the moving means 310 allows a chain route to be obtained that has a minimized path and substantially in a straight line with reference to the two main branches 112,114.

[0085] Therefore, this path enables the moving members to be crossed, i.e. the moving means 310, of the lower welding bell 214. In this way, it is possible to minimize the path performed by the feeding means 110, obtaining a smaller extension thereof. This leads to a reduction in the manufacturing cost of the packaging machine and, at the same time, a reduction in the energy consumptions connected with the activation of the feeding means themselves.

[0086] When the first tray has reached the welding position, the movement of the lower welding bell 214 is obtained through the moving means 310, along the welding direction WD which is perpendicular to the feeding plane FP, i.e. perpendicular to the feeding direction FD.

[0087] Such movement allows the lower welding bell 214 to be arranged, and the relative tray that it supports, in contact with the upper welding bell 212 when the leverage constituted by the rhombus linkage 312 has the relative vertices arranged along the welding direction WD at the maximum spacing.

[0088] Before performing such movement, the unwinding apparatus 216 must have unwound the necessary quantity of reel to arrange the heat-sealing film to be applied between the two welding bells 212, 214.

[0089] Once the coupling has been realized, i.e. when the lower welding bell 214 and the upper welding bell 212 are arranged in the working position, the lower bell 214 allows the vacuum to be realized and/or the controlled environment to be defined, e.g. filling with nitrogen, within which to perform the packaging operation. At the same time, the contact of the two welding bells 212, 214 allows the tray to be packaged with the heat-sealing film, applying the appropriate temperature according to the material to be applied.

[0090] In the steps of arranging the lower welding bell 214 in the operating position, the operating coupling between the moving means 310 and the welding bell 214 itself allows the separation distance SD to be reduced and finally eliminated. This is further possible by means of the plurality of apertures provided on the chains of the moving means 110 that allow the passage of the moving

means 310 themselves, i.e. of the moving plate 314.

[0091] Once the heat-sealing operation has finished, the feeding means 110 and the moving means 310 are moved in a synchronized way to allow both the recovery of the movement of the chains, and the recovery of the separation distance SD capable to allow the lower branch 114 to move between the lower welding bell 214 and the moving means 310.

[0092] The aforesaid operations are cyclically repeated, arranging by steps, one at a time, the subsequent trays at the welding positions.

[0093] The use of motors of the brushless type allows the management of the consumptions to be optimized, reducing the size of the packaging machine. At the same time, the motors of the brushless type offer the necessary management precision for the synchronization between the feeding means and the moving means.

[0094] This allows the technical effect according to the present invention to be maximized as the arrangement of the moving means in the operating condition with the lower welding bell is realized minimizing the impact on the feeding means.

[0095] The reduced path, in connection with the use of motors of the brushless type allows, as well as high precision in terms of productivity, also substantial energy savings of up to 30% with respect to a traditional asynchronous motor activating a path according to the prior art.

[0096] Furthermore, the straight line path of the chains notably reduces the possibility of the stretching/elongation thereof, as well as containing the number of components, such as pinions, guides and chain links, making the system more effective and reliable, and also quieter and more durable over time, reducing downtime and maintenance operations.

Claims

1. Packaging machine (10) for tray-packaged products comprising:

   - feeding means (110) of the closed-loop type configured to operate the forward feeding of trays along a feeding plane (FP), said feeding means (110) comprising an upper branch (112) which defines said feeding plane (FP), and a lower branch (114);
   - welding means (210) configured to operate the welding between a heat-sealing film and a tray at a welding position, said welding means (210) comprising an upper welding bell (212) and a lower welding bell (214) which are movable to each other;
   - moving means (310) of said lower welding bell (214) along a welding direction (WD) which is perpendicular to said feeding plane (FP) between a rest position in which said upper welding bell (212) and said lower welding bell (214) are spaced apart from each other, and a working position in which said upper welding bell (212) and said lower welding bell (214) are coupled to each other to operate the welding between the heat-sealing film and the tray;

   characterized in that when the upper welding bell (212) and the lower welding bell (214) are in the rest position, the moving means (310) are arranged separated from the lower welding bell (214) of a separation distance (SD) capable to allow the lower branch (114) of the feeding means (110) to move between the lower welding bell (214) and the moving means (310).

2. Packaging machine (10) according to claim 1, wherein the lower branch (114) of the feeding means (110) extends substantially parallel to the feeding plane (FP).

3. Packaging machine (10) according to claim 1 or 2, wherein the moving means (310) are configured to eliminate the separation distance (SD) and to move the lower welding bell (214) from the rest position to the working position.

4. Packaging machine (10) according to any one of claims from 1 to 3, wherein the feeding means (110) and the moving means of the lower welding bell (114) are configured to be operated in a synchronized fashion such that the movement of the lower branch (114) of the feeding means (110) between the lower welding bell (214) and the moving means (310) is stopped when the upper welding bell (212) and the lower welding bell (214) are in the working position.

5. Packaging machine (10) according to any one of the preceding claims, wherein the feeding means (110) are configured to operate a step-type feeding, wherein each tray is fed along to the feeding plane (FP) and stopped at the welding position.

6. Packaging machine (10) according to claim 5, wherein the feeding means (110) and the moving means (310) of the lower welding bell (114) are configured to be operated in a synchronized fashion such that the moving means (310) start to move the lower welding bell (114) toward the working position when the feeding means (110) stop a tray in the welding position.

7. Packaging machine (10) according to any one of the preceding claims, wherein the moving means (310) comprise a rhombus linkage, wherein the minimum spacing between the vertices arranged along the welding direction (WD) defines the rest position and the maximum spacing between the vertices ar-

ranged along the welding direction (WD) defines the working position.

8. Packaging machine (10) according to any one of the preceding claims, wherein the feeding means (110) and/or the moving means (310) comprise one or more motors of the *brushless* type.

9. Packaging machine (10) according to any one of the preceding claims, wherein the feeding means (110) comprise at least a chain of the closed-loop type, preferably a pair of chains arranged side by side, wherein each chain defines a closed loop.

10. Packaging machine (10) according to claim 9, wherein at least one chain is provided with one or more apertures to allow the passage of the moving means (310).

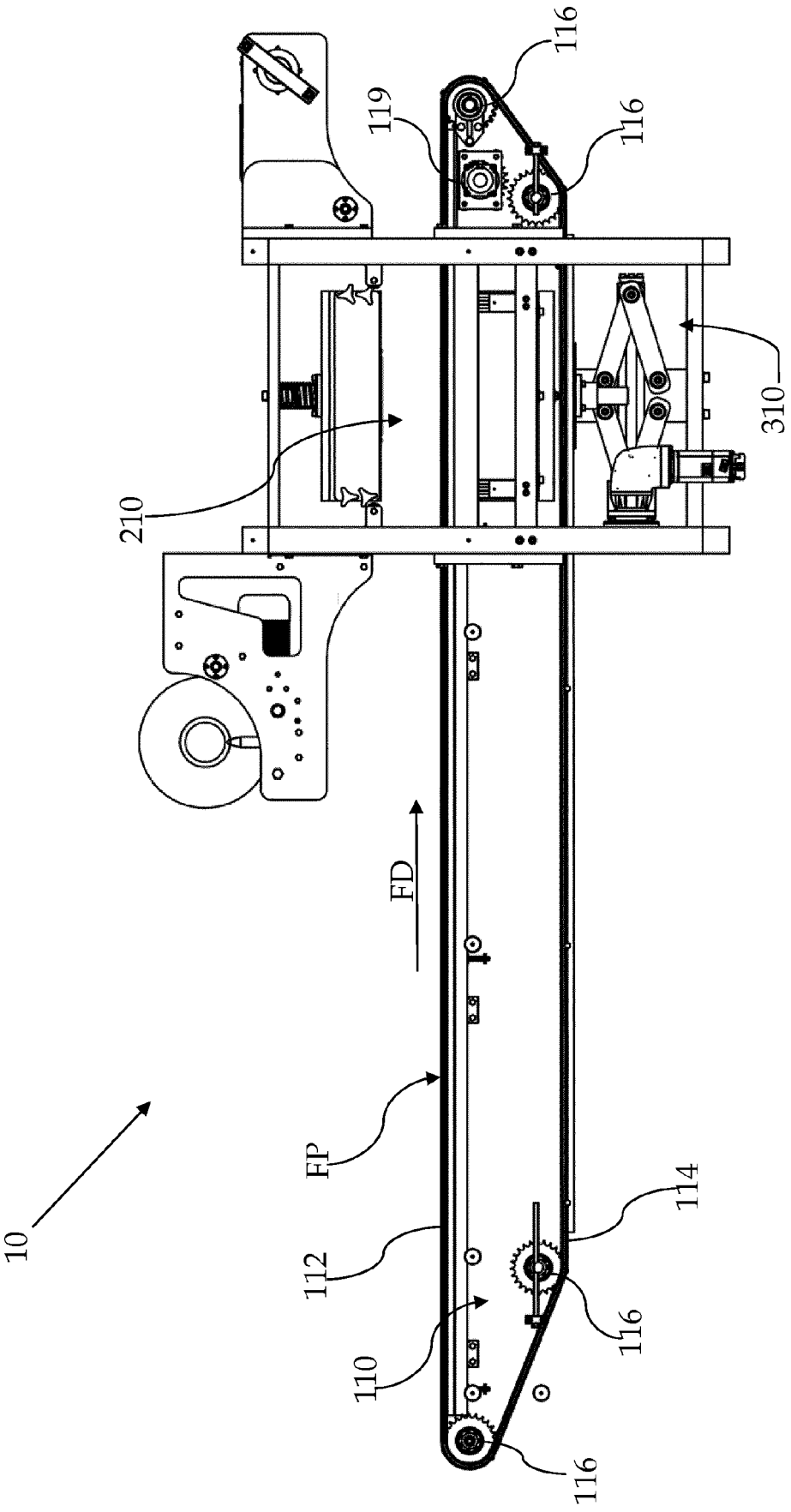


FIG. 1

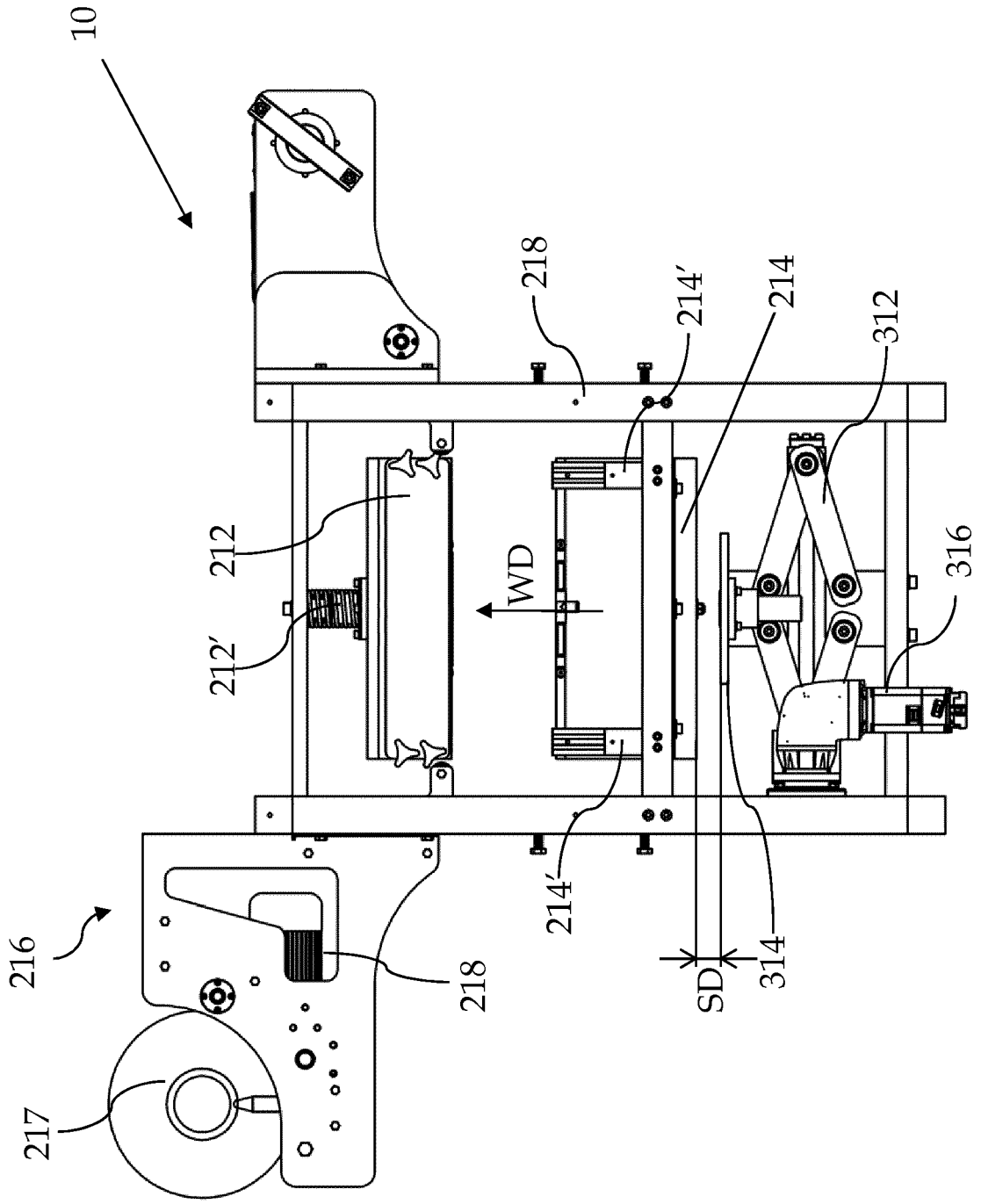
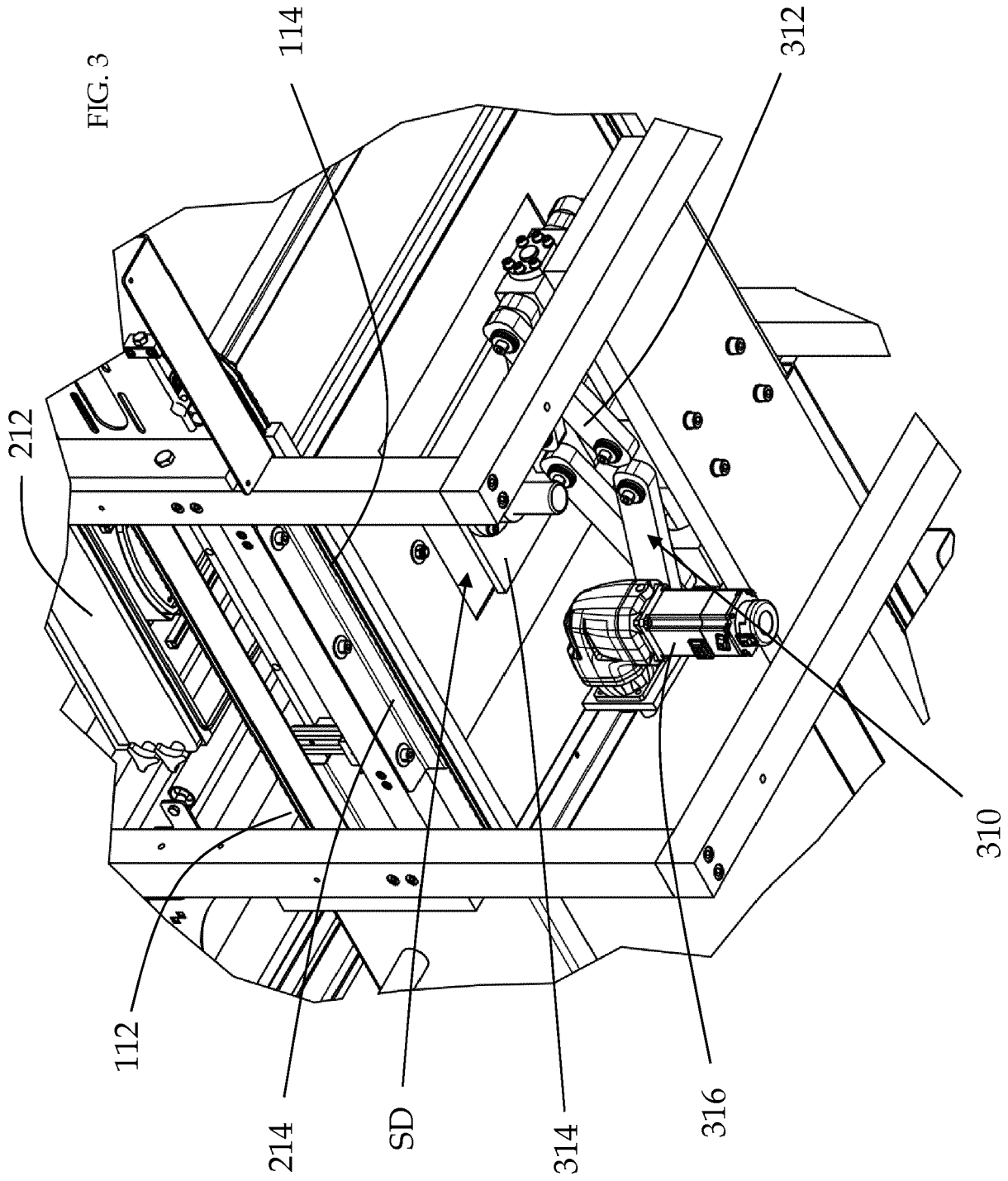


FIG. 2

FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 18 19 1937

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