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(54) Title: WRAPPING MACHINE FOR SINGLE OR GROUPED AND/OR STACKED PRODUCTS, IN PACKS OF THERMOPLASTIC MATERIAL OBTAINED FROM FILM UNWOUND FROM A REEL AND RELATED OPERATING METHOD

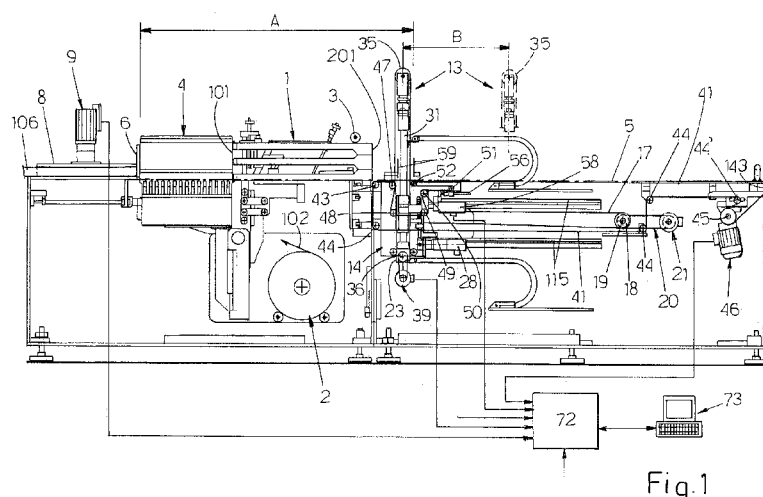


Fig.1

(57) Abstract: There is described a machine for packaging products in tubular wrappings of thermoplastic material obtained from continuous film unwound from a reel, equipped with a double transverse heat-sealing and intermediate cutting assembly (13) that, with a horizontal translation movement, accompanies the pack that the assembly (13) is closing the trailing end of to be unloaded while it is simultaneously closing the leading end of the tubular wrapper of the future pack that the heat-sealing and cutting assembly (13), also due to the presence thereon of pressers and counter-pressers (63, 163, 63', 163'), extracts from a tube-forming and longitudinal heat-sealing mandrel (1) and that, by the same assembly (13), is separated from the pack upstream with a transverse cut. At the end of its active movement, the transverse heat-sealing and cutting assembly (13) opens and with a horizontal movement in the opposite direction to and at a higher speed than the preceding one returns to the cycle start position, upstream of a new pack already filled and ready to be heat sealed at the trailing end and accompanied to be unloaded, repeating the cycle described. The transverse heat-sealing and cutting assembly (13) is aided by a conveyor (41) that supports and advances the packs being formed and those finished and separated, and that is equipped with a gap (40) with variable geometry, which opens during the active horizontal movement of the same assembly (13) and closes during the reverse horizontal movement of the same assembly (13).



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TITLE

WRAPPING MACHINE FOR SINGLE OR GROUPED AND/OR STACKED PRODUCTS, IN PACKS OF THERMOPLASTIC MATERIAL OBTAINED FROM FILM UNWOUND FROM A REEL AND RELATED OPERATING METHOD

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DESCRIPTION

The invention relates to a machine for wrapping single or grouped and/or stacked products, particularly paper or nonwoven products, for sanitary or other uses, in packs of thermoplastic material obtained from a film unwound from a reel and concerns the operating method of this machine.

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It should be noted that the terms “upstream” and “downstream” used hereinafter relate to the direction of feed of the packs.

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As state of the art closest to the invention, filed in the international class B65B63/02, the patent US 4 679 379, filed in 1983 by the same inventor of the present patent application, is cited. This document describes a packaging machine equipped with a horizontal hollow mandrel, of the type in the shape of a sailor neck tie, to one end of which there is fed a continuous sheet or film of thermoplastic material, unwound from a reel, which proceeding towards the opposite end of the mandrel, is formed in a tube with overlapping and heat-sealing of its longitudinal edges and that, upon delivery from the same mandrel, is closed transversely by a transverse static assembly that, on command, carries out a prior gusseting operation on the opposite sides of the same tubular wrapping and that on the gusseted portion of the same tube carries out two transverse heat seals and an intermediate cut, to close the trailing end of the pack filled and formed in the previous cycle, to close the leading end of the future pack to be formed and to separate the completed pack from the one being formed. Upstream of the tube-forming mandrel of the packaging film there is provided a loading station of the products to be packaged, for example toilet rolls, absorbent paper for kitchen or other uses, packs of napkins or hand towels, also in nonwoven, where these products are grouped together and/or stacked to form a bundle that is preferably subjected to slight pressure in transverse direction and

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that after this step has a cross section of a shape and width slightly less than the internal cross section of said hollow mandrel on the outside of which said tubular wrapping slides, gusseted and closed at the leading end. In correct phase, a pusher is activated to eject the bundle from said loading station, slide it along said hollow

5 mandrel and, at the exit thereof, push it against the closed leading end of the tubular wrapping, causing this wrapping to advance and, while it exits from the hollow mandrel, become engaged by the bundle, which due to the previous slight transverse compression to which it was subjected in said loading station and due to its elastic memory, expands slightly and closely engages the portion of tubular package ejected

10 from the mandrel and which with this is supported by conveyor means below. The pusher ends its active movement downstream of the mandrel and slightly downstream of the transverse heat-sealing and cutting assembly, which is in open position, after which the same pusher reverses its movement and returns to the cycle start position, to free the loading station and allow repetition of a new operating cycle.

15 In sequence, the lateral gusseting means of the portion of tubular wrapping positioned between the trailing end of the bagged bundle and the discharge mouth of the tube-forming mandrel are activated, followed by activation of the transverse heat-sealing and cutting assembly, which carries out closing of the trailing end of the filled pack, which closes the leading end of the pack being formed and still to be filled,

20 after which said assembly opens slightly to release the heat seals and allow action thereon of optional blower cooling means positioned on the same assembly, which in sequence opens fully to allow repetition of a new operating cycle, while the pack produced is moved away by the conveyor that supports it. When a new operating cycle is repeated, said transverse heat-sealing and cutting assembly must be fully

25 open to allow the tubular pack to advance pushed by the product inserted therein by the pusher that carries out its active operating movement. To prevent the heat seal of the leading end of the tubular pack being filled from yielding under the thrust of the product in the bagging step and therefore prevent the pack from tearing and bursting, also due to the air that is compressed by the product when it advances in the tubular

30 pack closed longitudinally and at the leading end, in the current state of the art it is

possible to act as follows:

- a) to ensure effective cooling of the heat seal of the leading end of the tubular pack, the idle times between one operating cycle and the next are extended;
- b) the product is inserted into the tubular pack being formed and closed at the leading end, at slow speed, to allow the air that remains trapped in the front part of the pack to escape by passing between product and pack. Just as the previous solution, this solution unavoidably limits the operating speed and consequently the productivity of prior art packaging machines.

The invention intends to overcome these and other limits of the prior art, to produce reliable packaging machines with high hourly production rates, with the idea of a solution according to the appended claim 1) and to the subsequent dependent claims, for which the transverse heat-sealing and cutting assembly is provided with pressers upstream and downstream of the heat-sealing means, so as to firmly clamp the film before, during and after the step of carrying out the transverse heat seals. In combination with said pressers, the same transverse heat-sealing and cutting assembly is movable in the pack forming direction, first closed and moving away from said tube-forming mandrel and then open and in the opposite direction, to return to the cycle start position for repetition of a subsequent operating cycle. The tubular pack can now advance along the tube-forming mandrel drawn by the new double transverse heat-sealing and cutting assembly with pressers, as a result of which it is possible:

1. to produce strong and efficient heat seals, with the times required to ensure proper implementation thereof, as these heat seals are carried out in the forming and filling step of each subsequent tubular pack, while the transverse heat-sealing and cutting assembly is closed and moves away from the mandrel;
2. while the new tubular pack advances drawn by the transverse heat-sealing and cutting assembly with pressers, which has heat sealed the leading end of the new pack, has closed the trailing end of the pack of the previous cycle and is accompanying this latter to be unloaded, the same new pack can be

filled rapidly by said pusher, as the presser downstream of this transverse heat-sealing and cutting assembly mechanically isolates the transverse heat seal of the leading end carried out on the new pack, so that this transverse heat seal is not stressed by insertion of the product into the new tubular pack and by thrust of the air trapped in the same pack and positioned in front of the product, also because in this step it is possible for the pusher to insert the product into the new pack with a relative speed that allows slow and progressive backward discharge of the air that is compressed upstream of the product;

3. during its movement away from the tube-forming mandrel, the transverse heat-sealing and cutting assembly has all the time required to carry out its main transverse heat-sealing and cutting operations and, in the last part of the same movement, it also has time to open the heat sealers slightly and allow action of the means for natural or forced cooling of the transverse heat seals carried out, while the film upstream and downstream is held by the pressers at all times to prevent even minimum stress on the same transverse heat seals;
4. the return movement to the cycle start position of the transverse heat-sealing and cutting assembly, after it has been opened, overlaps the return movement at the same speed of the pusher for bagging the product and, after this return step, a pack filled and ready for closing of the trailing end is already positioned downstream of the transverse heat-sealing and cutting assembly.

It is evident how with the new solution according to the invention, packaging machines that are more reliable and faster than those of the prior art can be produced.

Further characteristics of the invention, and the advantages deriving therefrom, will be more apparent from the following description of a preferred embodiment thereof, illustrated purely by way of non limiting example in the figures of the eight accompanying drawings, wherein:

- Figs. 1 and 2 are respectively side elevation and top plan views of a packaging machine according to the invention;
- Figs. 3 and 4 are respectively a side and front view, with parts in section, of one of the side panels of the moving transverse heat-sealing and cutting assembly of the packaging machine;
- Figs. 5, 5a and 5b are cross sectional views of the transverse heat-sealing and cutting assembly in the solution useful for producing packs with incorporated handle, the same assembly being illustrated respectively in the open position, in the closed position and in the semi-open or semi-closed position, with the transverse heat-sealing and cutting means open and with the outer pressers still closed on the packs downstream and upstream;
- Fig. 6 is a perspective view of a pack with handle that can be obtained with the transverse heat-sealing and cutting assembly of Fig. 5;
- Fig. 7 illustrates, in open position and in a cross sectional view, the transverse heat-sealing and cutting assembly according to a variant of embodiment useful for producing a pack with symmetrical heat seals of the leading and trailing ends, without the handle of Fig. 6;
- Fig. 8 illustrates a perspective view of a pack without a handle that can be produced with the transverse heat-sealing and cutting assembly of Fig. 7;
- Fig. 9 illustrates a schematic plan view of the means for prior lateral gusseting of the portion of tubular wrapping that is cyclically engaged by the double transverse heat-sealing and cutting assembly;
- Fig. 10 illustrates a side view, enlarged and with parts in section, of the variable gap area of the conveyor associated with the transverse heat-sealing and cutting assembly, to support the packs in the subsequent steps of the operating cycle in which the same packs pass cyclically through this gap in which the opposite bars of the transverse heat-sealing and cutting assembly operate;
- Figs. 11 to 16 illustrate schematic side views of the main components of the packaging machine according to the invention, in some subsequent and

significant steps of the operating cycle of these components.

From Figs. 1 and 2 it can be seen how the packaging machine comprises as intermediate component an axially hollow mandrel 1 in the shape of a sailor neck tie with a rectangular or square cross section, adjustable when the format of the pack to be produced changes, positioned horizontally with its longitudinal axis, equipped on the left when viewing the figures with an open end 101 from which the film 102 coming from a reel below 2 enters and which by guide means typical of mandrels in the shape of a sailor neck tie is made to adopt a tubular shape, to move longitudinally along the same mandrel 1 towards the outlet 201 thereof, with mutual overlapping of the longitudinal flaps of the same film and with continuous and mutual heat-sealing of these by a heat-sealing device of known type 3, so that the same film exits from the outlet 201 of the mandrel 1 in the form of a sack and with a cross section of a size slightly larger than the inner cross section of the same mandrel 1 that externally guides and supports said sack of film and that with its inner lateral surface is instead destined to guide the product to be packaged. Upstream of the mandrel 1 there is provided the known loading station 4 in which means, also known, form a bundle of grouped and/or stacked products, coming from at least any one feed line, not shown as not necessary in order to understand the invention. The loading station 4 is also adjustable when the format of the packs to be produced changes and can advantageously be characterised by subjecting the bundle of paper product to an adequate transverse compression, so that when the same bundle is ejected longitudinally from the loading station 4, it can easily enter the hollow mandrel 1 and can slide along it still in a condition of adequate transverse compression.

In Fig. 1, the dot and dash line 5 indicates the ideal horizontal plane on which the bottom of the bundle and the packs produced by the packaging machine in question move. Upstream of the loading station 4 there is provided the pusher 6 supported by the front end of a horizontal rod 106, whose longitudinal axis is parallel to the common longitudinal axis of the aforesaid stations 1 and 4 and that extends to the left when viewing Figs. 1 and 2. At the end next to the pusher 6, the rod 106 is guided longitudinally by rolling means 7 supported by a base plate 8 in the form of a

portal, on which there is also mounted a gear motor assembly 9, on the vertical output shaft of which there is press fitted a toothed pulley 10 that cooperates with a toothed belt 11 guided on a pair of idle pulleys 12 and parallel to the pulley 10, also supported by the portal 8, so as to carry the same toothed belt 11 in a path parallel to
5 the rod 106 and to be able to be fixed thereto with the opposite ends, so as to form the equivalent of a rack fixed longitudinally to the rod 106 and meshing with the pinion 10, so that by rotating the motion unit in one or other direction, it is possible to operate the pusher 6 in the useful movement for transfer of the bundle formed in the loading station 4 along the tube-forming mandrel 1 and downstream thereof and of
10 the transverse heat-sealing and cutting assembly (see below), for insertion of the same bundle into the tubular pack produced by the same mandrel 1 and by the longitudinal heat-sealing device 3, with a movement indicated with A in Figs. 1 and 2. The assembly 9 is equipped with an electric motor that not only can rotate in two directions but also with electronic speed control, to allow operation of the pusher 6
15 with a varied motion, with correct acceleration and deceleration ramps (see below).

Downstream of the mandrel 1, at a short distance from the outlet 201 thereof, there is provided the innovative assembly 13 that carries out the double transverse heat seal and the intermediate cut on the pack and that, according to the invention, after closing on the vertical plane, is operated first with a horizontal movement away
20 from the same mandrel 1, to accompany the pack in the transverse heat-sealing and cutting step and then, after opening on the vertical plane, is translated horizontally in the opposite direction to the preceding one, to return to the initial starting position illustrated with a continuous line in Figs. 1 and 2, for repetition of a new operating cycle, carrying out reciprocating movement B, the length or range of which will be
25 correlated to the length of the packs to produce and will therefore be variable (see below).

In order to perform said horizontal translation movement B, as also illustrated in the details of Figs. 3 and 4, the assembly 13 is mounted on a carriage 14 that by means of lateral recirculating ball slides 15, slides on pairs of rectilinear and
30 horizontal guides 115 fixed longitudinally on the inner faces of the side panels of the

portion of base plate 116 of the packaging machine that extends downstream of the one 16 (fig. 2) that supports the stations 1, 4 and 6 described previously. Parallel to the pairs of guides 115, between these and parallel thereto, the inner side panels of the base plate 106 support toothed belts 17 closed in a loop and guided on
5 respective end pulleys 18, one pair of which is interconnected by a transverse shaft 19, in turn connected by means of a positive motion transmission 20 to a motion assembly 21 with electric motor that rotates in two directions and preferably of the type with electronic speed and phase control. The two side panels of the carriage 14, which can be carried in the rectilinear reciprocating movement of the aforesaid
10 range B by the motion assembly 20, are fixed to the upper branch of the two toothed belts 17 with clamps 22 (fig. 3).

The assembly 13 comprises two elements 113' and 113" parallel to and opposite each other, positioned on a common ideal vertical plane, transverse to the longitudinal direction of the ideal plane 5 of advance of the packs, the lower 113" of which is positioned under this plane 5 at the start of each cycle, while the upper
15 element 113' is raised and at a distance from the plane 5 that allows the packs cyclically exiting from the mandrel 1 to pass below without interference. In the active operating step, the elements 113', 113" are moved towards each other with a self-centring movement on the common ideal vertical plane, so as to meet approximately
20 at half the height of the packs to be closed. To allow the machine to produce packs of different height, the position in height of the support and guide means of said elements 113' and 113" can be adjusted simultaneously, without adjusting the related distance at rest. For this purpose, as illustrated in Figs. 3 and 4, the support means of said elements 113' and 113" are mounted on respective vertical slides 23
25 positioned inside the side panels of the carriage 14 that support these slides with guide means 24. Each slide 23 is equipped with an protruding intermediate appendage 123, with a lead screw 125 that cooperates with a vertical screw 25, in turn connected, with the interposition of a safety coupling 26, to a three-way bevel gearbox 27, the vertical way of which acts on the screw 25, while one of the
30 horizontal ways connects the screw 25 of a slide to that of the slide of the opposite

side, which will be served by a two-way bevel gearbox, while the third horizontal way of the gearbox 27 is connected to a motion assembly 28 with electric motor that rotates in two directions and preferably of the type with electronic speed and phase control, to allow the automatic or semi-automatic adjustment of the position in height
5 of the transverse heat-sealing and cutting assembly 13.

Fixed to the inner sides of the aforesaid vertical slides 23 with supports 29 and 30 that respectively support them by the lower end and by an intermediate area, are vertical guide rods 31, with a round section, sliding on which, with the interposition of recirculating ball bearings, are sleeves 32 and 33, the lower of which 32 slides
10 between said supports 29, 30 and supports the end of the lower transverse heat-sealing and cutting element 113", while the upper sleeves 33 slide above the supports 30 of the respective rods 31 and support the ends of the upper transverse heat-sealing and cutting element 113'. In Figs. 3 and 4 it can also be seen that the sleeves 32 and 33 of each rod 31 are fixed by means of respective clamps 132, 133
15 to the opposite branches of toothed belts 34 guided on a pulley 35 supported adjustably by the upper end of each rod 31 and on a toothed pulley 36 supported by the lower end of each vertical slide 23 and the same lower pulleys 26 are connected to each other by a synchronizer shaft 37, which by means of a positive motion transmission 38 is connected to a motion assembly 39 with electric motor that rotates
20 in two directions and preferably of the type with electronic speed and phase control. The opposed elements 113' and 113" of the transverse heat-sealing and cutting assembly 13 receive the movements for the opening and closing steps from this motion assembly, with the necessary acceleration and deceleration ramps, as indicated below.

From Figs. 1 and 2 and 10 to 12, it can be seen that the same ideal vertical plane on which the elements 113' and 113" of the transverse heat-sealing and cutting assembly 13 move, is provided with the transverse opening or gap 40 of the upper branch of a conveyor 41, which with the same upper branch moves in the direction of the arrow 42 and lies on the horizontal operating plane 5 to support the packs during
25 exit from the mandrel 1, during their movement away from it, while transverse heat-

sealing of the trailing and leading ends and the intermediate cut is carried out dynamically on the same packs (see below). When the elements 113', 113" of the assembly 13 are in the open position at rest and have to carry out the return movement to be arranged upstream of the new pack that has been unloaded from the mandrel 1 (see below), it must be possible to substantially close said transverse gap 40, to allow this new pack to pass over it. For this purpose, the upper branch of the conveyor 41 is guided on a roller 43 positioned at the outlet of the mandrel 1 and supported rotatively by the side panel of the base plate 116 of the packaging machine, together with the end roller 143. The lower branch of the conveyor 41 is instead guided on idle rollers 44, on at least one dancer roller 44' and on a toothed pulley 45 press fitted onto the slow output shaft of a motion assembly 46. A short distance from the upper roller 43, the upper branch of the conveyor 41 is guided on a roller 47 parallel to and positioned at the same height as the roller 43 and is then guided on three lower rollers 48, 49 and 50, also parallel to one another, idle and parallel to the roller 47, and which with this take the same upper branch of the conveyor 41 to form said gap 40 in which the lower element 113" of the transverse heat-sealing and cutting assembly 13, in its lowered rest position, can be positioned and through which the same element 113" can, on command, be raised to cooperate with the upper element 113'. The rollers 47 to 50 are supported rotatively by the carriage 14 and move therewith. The roller 50 is positioned at a lower height than the roller 47, so that two idle rollers 51 and 52, positioned respectively downstream and upstream of the same roller 50, and the latter of which is at the same height as the roller 47, can be placed above the same roller 50. Passing over the rollers 50, 51 and 52, the conveyor belt 41 takes a zigzag path. The rollers 51 and 52 are mounted rotating on a small secondary carriage 53 that is mounted on the main carriage 14 and is able to carry out thereon, on command, a controlled horizontal movement that can take the same rollers 51 and 52 from the moved back position of Fig. 11, in which the gap 40 is substantially closed and the pack can pass easily over the rollers 47 and 52, to the extended position of Fig. 12 in which the gap 49 is open to allow freedom of movement on the vertical of the lower element 113" of the transverse

heat-sealing and cutting assembly 13.

From the details of Fig.10 it can be seen that the rollers 51, 52 are mounted transversely on the opposite ends of a said secondary carriage 53, equipped laterally with horizontal and longitudinal guides 153 sliding on slides 54 fixed on the top of a cross member 55, in turn fixed with the its ends to the side panels of the main carriage 14. The cross member 55 supports, rotatingly and in a cantilever fashion, a pair of screws 56 parallel to each other and to the guides 54 and lead screws 156, integral with appendages 253 of the secondary carriage 53, cooperate with these screws 56. The two screws 56, only one of which is visible in Fig. 10, are operated by means of a positive motion transmission 57 by a motion assembly 58 flanged to the cross member 55 and operated by an electric motor that rotates in two directions and optionally also with electronic phase control.

In Fig. 10, the secondary carriage 53 with the rollers 51 and 52 is illustrated with a continuous line in the extended position that closes the gap 40, while it is illustrated with a dashed line in the moved back position that opens the same gap 40. The same figure clearly shows how the rollers 51 and 52 carry out movements D of equal range and such that when the roller 52 moves back to the left, when viewing Fig. 10, and causes a double shortening D of the upper part of the conveyor 41, the lower roller 51 also moves to the left and causes a double lengthening D of the lower part of the same conveyor 41, so that the movements of the secondary carriage 53 do not modify the longitudinal tension of the same conveyor 41 and do not modify its movement.

From Figs. 1, 2 and 9 it can be seen that opposed folders 59, 59' are provided at the side of the conveyor 41 and at the transverse heat-sealing and cutting assembly 13, which prior to operation of the same assembly 13 act on the sides of the portion of tubular pack exiting from the mandrel 1, which is not engaged by the product to be packaged (see below) and that is to be engaged by the same assembly 13, to produce recessed lateral gusseting on the same portion of pack, which are useful to prevent the heat sealed area from protruding laterally from the pack and to ensure that the same area closely wraps the end of the packaged products. The

folders 59, 59' can be mounted adjustably on respective slides 60, 60' sliding on guides 61, 61' constrained to the fixed frame 116 of the packaging machine, the same slides 60, 60' being operated by respective fluid pressure piston cylinder assemblies 62, 62' or by other suitable linear reciprocating motion actuators.

5 With reference to Figs. 5, 5a and 5b, the composition of the means that form the elements 113' and 113" of the double transverse heat-sealing and intermediate cutting assembly 13 is now described. In Fig. 5 the elements 113' and 113" are illustrated in the step of movement towards each other and that, with a greater distance between the same elements, is equivalent to the rest position of the same
10 elements 113', 113" of the assembly 13. The transverse heat-sealing and cutting assembly, which is now described with reference to Fig. 5, is able to produce a pack C1 as shown in Fig. 6, closed longitudinally by the heat seal SL formed by the heat-sealing device 3 shown in Figs. 1 and 2, equipped at the ends with the portions F recessed and gusseted by the folders 59, 59' of Fig. 9, closed at the leading end by a
15 transverse heat seal ST1, closed at the trailing end by a transverse heat seal ST2 and equipped with a flattened and gusseted portion M of the same pack, also closed longitudinally by the heat seal SL, which is closed on the free edge B2 by fusion of the material obtained from the separation with a hot cut between subsequent packs, and which is equipped with a C-shaped intermediate cut G, useful to be able to use
20 the same portion M of pack as a handle for carrying the same pack C1. At the transverse leading end seal ST1, the pack C1 has a small protruding appendage of the same pack, the front edge B1 of which, parallel to ST1, is closed by fusion of the material obtained from the separation with a hot cut between subsequent packs.

25 The assembly 13 must be able to carry out simultaneously, on the portion of tubular pack on which it is pressed transversely, the parallel heat seals ST2 for the pack already filled and to be closed at the trailing end, the parallel heat seal ST1 for the following pack still to be filled with product, the intermediate cut that produces the edges B2, B1 and the mutual separation of the packs and to carry out punching to form the opening G acting as handle.

30 From Fig. 5 it can be seen that the upper element 113' of the assembly 13 is

equipped at least upstream, but preferably both upstream and downstream, with pressers 63, 63', which with their lower edge with rounded profile, both project downwards with respect to the lower operating surface of the same element 113', and which can move back towards this operating surface, in opposition to the action
5 of counter springs 64, 64'. On the lower operating surface of the element 113', in a position vertically and horizontally moved back from the pressers 63, 63' and arranged coplanar with each other, there are provided the heat sealing devices 65 and 66 for carrying out the heat seals ST1 and ST2 of Fig. 6, and the hot cutting means 67 for separating the packs from one another and for forming the fused edges
10 B1 and B2 of the same pack of Fig. 6. In the intermediate part of the lower operating surface of the element 113' there are provided two small spring operated pressers 68, 68', the lower and suitably rounded edge of which projects slightly downwards from the ideal plane that contains the heat sealing devices 65, 66 and, in a position moved back from these intermediate pressers 68, 68', there is provided a punching
15 unit 69 for forming the cut G on the handle M of the pack C1 of Fig. 6. The whole assembly 113' is supported by the support part 70 positioned above connected to the sleeves 33 shown in Figs. 3 and 4, with the interposition of spring and compensation means 71, common in the transverse heat sealing and cutting means in question.

The lower element 113" of the assembly 13 as shown in Fig. 3 comprises, with
20 arrangement on a common ideal horizontal plane, counter means 163, 163' opposite the pressers 63, 63', counter-heat sealing devices 165, 166 opposite the heat sealing devices 65, 66, a counter means 167 for the cutting means 67, counter means 168, 168' for the intermediate pressers 68, 68' and a punch 169 for the upper punching unit 69. The pressers 63, 63' and the respective counter means 163, 163 are
25 produced or machined so as to have a high coefficient of friction in contact with the film that forms the packs and that exits from the tube-forming mandrel 1.

Moving the elements 113' and 113" of the transverse heat-sealing and cutting assembly 13 towards each other in parallel, as shown in Fig. 5, with self-centring movement on the common ideal vertical plane, the outer pressers 63, 163 and 63',
30 163', as shown in Fig. 5b, act first, firmly clamping in transverse direction the

interposed tubular pack, not illustrated, and then, continuing the movement towards each other, the same elements 113', 113" reach the condition of Fig. 5a, useful for producing on the pack C1 said heat seals ST1, ST2, the intermediate cut B1-B2, with action in correct phase of the intermediate pressers 68, 168, 68', 168', which firmly
5 retain the portion of pack that is provided with the cut G by the elements of the punching unit and punch 69, 169. After said transverse heat sealing and cutting operations have taken place, the elements 113', 113" of the assembly 13 are taken temporarily to a partially open condition, as shown in Fig. 5b, with raising of the heat sealers 65, 66 and of the cutting means 67 by the respective lower counter means
10 165, 166, 167, to allow rapid natural or forced cooling of the heat seals and of the transverse cut carried out, while the pack remains clamped between the outer pressers and counter pressers 63, 163 and 63', 163' so that it can be drawn further by the assembly 13, as indicated below.

If the machine is to produce packs C2 as shown in Fig. 8, without a handle, but
15 equipped only with the transverse leading and trailing end heat seals ST1 and ST2 with the fused edges B1 and B2, resulting from the hot cutting operation of the pack, at a short distance therefrom, the transverse heat sealing and cutting assembly 13 will be simplified as shown in Fig.7, with the upper element 113' equipped only with the outer pressers 63, 63', the heat sealers 65, 66 and the hot cutting means 67,
20 while the lower element 113" will carry the counter means 163, 163', 165, 166, 167 for the aforesaid operating means positioned above.

In Fig. 1, the numeral 72 indicates a processor programmable through a unit 73, and to which all the electric motors of the aforesaid motion assemblies are connected, to allow automatic and safe operation of the packaging machine, as is
25 now described with reference to Figs. 11 to 16.

Fig. 11 illustrates the transverse heat sealing and cutting assembly 13, which previously carried out heat sealing of the trailing end of the finished pack C1, heat sealing of the leading end of the new pack C1' and the intermediate transverse cut to separate from the new pack C1' the pack C1, which is moved away by the upper
30 branch of the conveyor 41 that moves in the direction 42 to be unloaded, also to

maintain the subsequent pack C1' exiting from the mandrel 1 lying longitudinally as a result of the pull exerted previously by the same assembly 13 in the previous movement to the right, when viewing Fig. 11, as the same new pack C1' has in correct phase been filled by the pusher 6, which in correct phase moves back as indicated with the dashed line. The elements 113', 113" of the assembly 13 are spaced from each other or open, with the lower element 113" inside the gap 40 and with the upper element 113' in raised position so as not to interfere with the new pack C1'. The gap 40 is in this phase closed to prevent interference when passing below the same new pack C1' and is arranged upstream of this pack C1'.

In the subsequent step illustrated in Fig. 12, the secondary carriage 53 moves to the right and opens the gap 40 to free the ideal vertical plane on which the elements 113', 113" of the transverse heat-sealing and cutting assembly 13 move. After the static folders 59, 59' of Fig. 9 have acted laterally on the portion of tubular wrapping 102' between the outlet of the mandrel 1 and the product P inserted in the new pack C1', to equip this portion of wrapping with lateral recessed gussets, according to the prior art, the elements 113' and 113" of the assembly 13 are commanded to carry out a self-centring closing movement which closes them immediately downstream of the product P packaged in C1' and at half the height of this same pack, in the fully closed condition shown in Fig. 5a or in the partially closed condition shown in Fig. 5 or in Fig. 5b. In correct phase with total or partial closing of the elements 113', 113", the lateral folders 59, 59' are moved back to the rest position and, in sequence, the main carriage 14 that carries the assembly 13 is translated to the left. If the elements 113', 113" of the assembly 13 are not fully closed, as shown in Fig. 5 or Fig. 5b, the initially slow movement of the same assembly 13 away from the mandrel 1 and the resistance created by the tube of film 102 that impacts the tube-forming mandrel 1, can cause the pack C1' to move close to the assembly 13 to allow an adequately tight wrapping to be formed also in longitudinal direction. In sequence, the elements 113', 113" of the assembly 13 are closed as shown in Fig. 5a so as to firmly clamp the trailing end of the pack C1' and to carry out thereon the transverse heat seal ST2 of Fig. 6, the separation with hot cut (forming of the closed edges B2 and B1 and

their separation) from the subsequent pack C1" exiting from the mandrel 1 that the assembly 13 starts to draw and to carry out the cold cut G to equip the same pack C1' with the carrying handle M.

While the assembly 13 moves to the right, as illustrated in Fig. 14, the pusher 6 inserts the product P to be packaged into the future pack C1", in which the same product expands transversely due to the previous transverse compression to which it was subjected in the loading station 4 shown in Figs. 1 and 2 and the insertion speed of the same product in the wrapper of C1" can be such that the air trapped in this pack and positioned upstream of the product P being packaged, escapes slowly downstream, without damaging the same pack C1", which is nonetheless firmly retained by the presser upstream 63, 163 of the assembly 13, this latter which is taken in correct phase to the condition shown in Fig. 5b to allow rapid cooling of the heat seals carried out by the same assembly 13.

From Fig. 14 it is thus evident that while the assembly 13 dynamically carries out its operations of double transverse heat-sealing and cutting it has been designated with, at the same time a new pack already filled with the product P to be packaged is formed downstream of this assembly (see starting condition of Fig. 11).

In sequence, as illustrated in Fig. 15, when the carriage 14 reaches or is about to reach the end of its movement to the right, the elements 113', 113" of the assembly 13 open, with the lower element 113" that returns into the open gap 40 and with the upper element 113' that is arranged at a greater height than that of the upper part of the pack C1".

As illustrated in Fig. 16, in close sequence to the preceding step, the secondary carriage 53 is moved to the left to close the gap 40 and then the main carriage also translates to the left to return to the cycle start position shown in Fig. 1, without the slightest interference with the bottom of the new pack C1", which is maintained lying flat by the active movement 42 of the conveyor 41. The pusher 6 is, or has already been, moved back in correct phase to repeat a new operating cycle. The return movement to the start of the cycle by the assembly 13 in open position can take place very rapidly, further increasing the productivity of the packaging machine.

It is understood that the description refers to a preferred embodiment of the invention, to which numerous variants and modifications can be made, all without departing from the guiding principle of the invention, as described, illustrated and as claimed below.

- 5 In the claims, the references indicated in brackets are purely indicative and do not limit the scope of protection of these claims.

CLAIMS

1. A wrapping machine for wrapping individual or grouped and/or stacked products, in packs of thermoplastic material of the type comprising a hollow horizontal mandrel (1) to the loading end (101) of which there is fed a continuous film of thermoplastic material (102), unwound from a reel (2), which proceeding towards the unloading end (201) of this mandrel, is formed in a tube with overlapping and mutual heat-sealing of its longitudinal edges by heat-sealing means (3) and which exits from the same mandrel (1) in the form of a tubular wrapping (102'), which is closed transversely by an assembly (13) positioned downstream of the same mandrel (1) and which, on the portion of the tubular wrapping previously gusseted by folders (59, 59'), carries out two transverse heat seals (ST1, ST2) and an intermediate cut (B1, B2), filled and formed in the previous cycle, to close the leading end of the following pack (C1'') and to separate the completed pack (C1') from the one being formed (C1''), and which comprises upstream of said mandrel (1) and aligned longitudinally therewith, a loading station (4) of the products (P) to be packaged, grouped and/or stacked and compressed in transverse direction and which upstream of this station (4) comprises aligned longitudinally, a pusher (6) that, on command, transfers the product or products (P) from the loading station (4) into the tubular pack produced by said mandrel (1), passing through this latter for the whole of its length and beyond, **characterised in that** the parallel and opposed elements (113', 113'') that form said assembly (13) for carrying out the double transverse heat seal and the intermediate cut, are equipped upstream with respective pressers (63, 63') and counter-pressers (163, 163') to firmly clamp in transverse direction the portion of gusseted wrapping (102') on which this assembly (13), on command, is closed, the same assembly (13) being mounted on a main carriage (14) with horizontal movement and operated by motion means to be able in correct phase to be moved away from the tube-forming mandrel (1) to follow the completed pack during heat sealing of the trailing end and to extract from the mandrel (1) a new portion of tubular wrapping (102') into which in correct phase said pusher (6) inserts a product (P) to form said subsequent pack (C1''), there being

provided means such that said main carriage (14) is returned rapidly to the initial position moved towards the mandrel (1), to be arranged downstream of the new pack (C1'') already filled and to be closed at the trailing end, a motorized conveyor (41) being provided to support the packs being formed downstream of said mandrel (1) and the upper branch of this conveyor (41) being guided on parallel rollers (47, 48, 49, 50) supported rotatably by said main carriage (14) and being guided in a zigzag path on further rollers (51, 52) supported by a secondary carriage (53) sliding horizontally on command on the same main carriage (14), all so as to form at said double transverse heat-sealing and intermediate cutting assembly (13) a gap (40) inside which the lower element (113'') of said assembly (13) is normally housed and this gap (40) being opened by the movement in one direction of said secondary carriage (53), to allow freedom of action of this lower element (113'') and the same gap (40), when engaged by said lower element (113''), being closed by the movement of said secondary carriage (53) in the opposite direction, so that said conveyor (41) correctly supports the packs being formed during the return movement of said main carriage (14).

2. The wrapping machine according to claim 1), wherein the main carriage (14) that carries said double transverse heat-sealing and cutting assembly (13), is equipped laterally with slides (15) that slide on pairs of rectilinear and horizontal guides (115) fixed longitudinally to the side panels of the portion of base plate (116) of the same machine and these side panels also support, parallel to said pairs of guides (115), toothed belts (17) closed in a loop and guided on respective end pulleys (18), a pair of which is interconnected by a transverse shaft (19) in turn connected to a motion assembly (20, 21) with electric motor that rotates in two directions and of the type with electronic speed and phase control, the two side panels of the main carriage (14) being connected to a branch of said two toothed belts (17) by means of clamps (22), to receive therefrom the necessary rectilinear reciprocating movement with the necessary acceleration and deceleration ramps.

3. The wrapping machine according to claim 1), wherein the support means of the two parallel and opposed elements (113', 113'') that form said double transverse

heat-sealing and cutting assembly (13), are mounted on respective vertical slides (23) positioned inside the side panels of the main carriage (14) that support said slides (23) with guide means (24), each slide (23) being equipped with a protruding intermediate appendage (123), with a lead screw (125) that cooperates with a vertical screw (25), in turn connected to a three-way bevel gearbox (27), the vertical way of which acts on said screw (25), while one of the horizontal ways connects the same screw (25) of a slide (23) to that of the slide (23) of the opposite side, which will be served by a two-way bevel gearbox, while the third horizontal way of said gearbox (27) is connected to a motion assembly (28) with electric motor that rotates in two directions and preferably of the type with electronic speed and phase control, to allow the automatic or semi-automatic adjustment of the position in height of the transverse heat-sealing and cutting assembly (13) when the height of the packs to be produced varies.

4. The wrapping machine according to claim 3), wherein fixed to the inner sides of said vertical slides (23) with supports (29, 30) that respectively support them by the lower end and by an intermediate area, are vertical guide rods (31), with a round section, sliding on which, with the interposition of recirculating ball bearings, are sleeves (32, 33) the lower of which (32) slides between said supports (29, 30) and supports the end of the lower transverse heat-sealing and cutting element (113"), while the upper sleeves (33) slide above the upper supports (30) of the respective rods (31) and support the ends of the upper transverse heat-sealing and cutting element (113'), the sleeves (32, 33) of each said rod (31) being fixed by means of respective clamps (132, 133) to the opposite branches of toothed belts (34) guided on a pulley (35) supported adjustably by the upper end of each rod (31) and on a toothed pulley (36) supported by the lower end of each said vertical slide (23) and the same lower pulleys (26) are connected to each other by a synchronizer shaft (37), in turn connected to a motion assembly (38, 39) with electric motor that rotates in two directions and preferably of the type with electronic speed and phase control, which transmits to the opposed elements (113', 113") of the transverse heat-sealing and cutting assembly (13) the movements for total or partial closing or total or partial

opening, with the necessary acceleration and deceleration ramps.

5 **5.** The wrapping machine according to claim 1), wherein the pressers (63, 63') positioned upstream and downstream of the upper element (113') of the double transverse heat-sealing and cutting assembly (13), are stressed in downward extension by respective counter springs (64, 64') so that when they are at rest, the lower edges with rounded profile of the same pressers are suitably spaced from each other by the lower operating surface of the same upper element (113'), while the lower element (113'') of the same assembly (13) comprises with arrangement on a common horizontal ideal plane, counter means (163, 163') opposite said upper
10 pressers (63, 63') which, similarly to these counter means (163, 163') are produced or machined so as to have a high coefficient of friction in contact with the tubular wrapping (102') of film that forms the packs and that exits from said tube-forming mandrel (1), all so that, also in combination with the action of said counter springs (64, 64'), said wrapping of film (102') is able to be firmly clamped between these
15 pressers (63, 63') and the respective counter means (163, 163) both when said elements (113', 113'') are thrust against each other to carry out the two transverse heat seals and the intermediate cut for which they are responsible, and when these elements (113', 113'') are close to each other but with the transverse heat-sealing and intermediate cutting means (65, 66, 67) raised by the respective counter means
20 (165, 166, 167), to free and cool the heat sealed and cut portions of wrapping.

25 **6.** The wrapping machine according to claim 2), wherein said secondary carriage (53) that supports the zigzag guide rollers (51, 52) of the upper branch of the conveyor (41), is equipped laterally with horizontal and longitudinal guides (153) sliding on slides (54) fixed on the top of a cross member (55), in turn fixed with its ends to the side panels of the main carriage (14), this cross member (55) supporting
30 rotatingly and in a cantilever fashion, a pair of screws (56) parallel to each other and to said guides (54) and these screws (56) cooperate with respective lead screws (156), integral with appendages (253) of the secondary carriage (53) and these screws (56) being operated by a motion assembly (57, 58) flanged to said cross member (55) and operated by an electric motor that rotates in two directions and

optionally also of the type with electronic phase control.

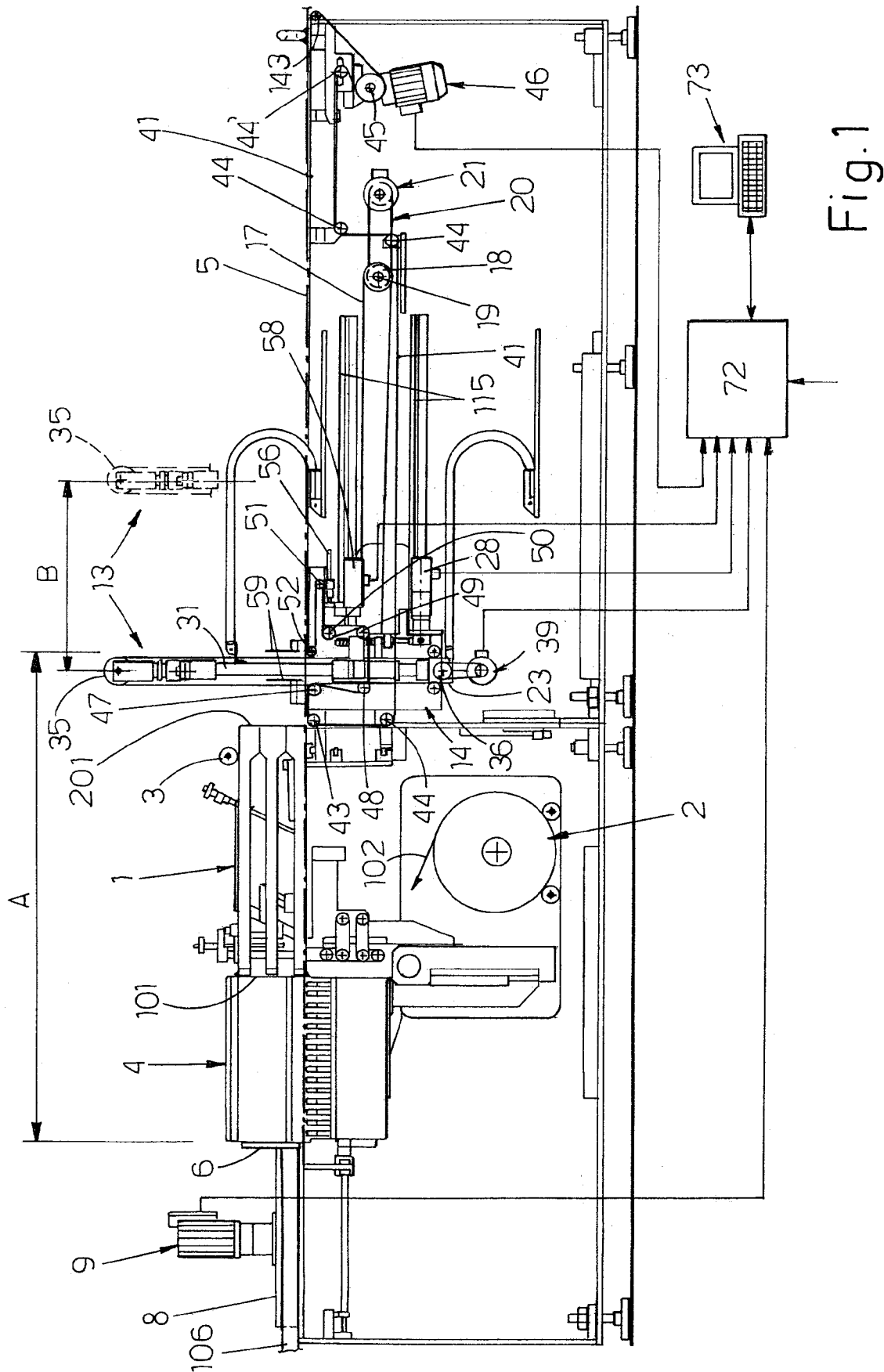
7. A method for wrapping single or grouped and/or stacked products (P), in packs of thermoplastic material obtained from film unwound from a reel, with a machine according to the preceding claims 1 to 6, with a transverse heat-sealing and cutting assembly (13) equipped with pressers and counter pressers (63, 163, 63', 163') upstream and downstream of the transverse heat-sealing and cutting means (65, 165, 67, 167, 66, 166), to be able to firmly clamp the tubular pack of film during the step of carrying out the transverse heat seals and in which the same transverse heat-sealing and cutting assembly (13) is movable in the pack forming direction, first closed and moving away from the tube-forming mandrel (1) and then open and in the opposite direction, to return to the cycle start position for repetition of a subsequent operating cycle, all so that advance of the tubular wrapping (102') along the tube-forming mandrel (1) can take place drawn by the same double transverse heat-sealing and cutting assembly (13) with pressers, characterised in that with this assembly (13) it is possible to carry out in the forming and filling step of each subsequent tubular pack (C1, C1', C1'' etc.), while the transverse heat-sealing and cutting assembly (13) is closed and moves away from the mandrel (1) and also characterised in that the return movement to the cycle start position of the transverse heat-sealing and cutting assembly (13), after it has been opened, overlaps the return movement at the same speed of the pusher (6) for bagging the product and, after this return step, a pack (C1'') filled and ready for closing of the trailing end is already positioned downstream of the transverse heat-sealing and cutting assembly (13).

8. The method according to claim 7), characterised in that while the new tubular pack (C1') advances and is drawn by the transverse heat-sealing and cutting assembly (13) with pressers (63, 163, 63', 163'), which heat seals the leading end of this new pack, closes the trailing end of the pack (C1) of the previous cycle and is accompanying this latter to be unloaded, the same new pack (C1') can be filled rapidly by the designated pusher (6), as the presser (63, 163) downstream of this transverse heat-sealing and cutting assembly (13), mechanically isolates the transverse heat seal of the leading end (ST1) carried out on the new pack, so that

this transverse heat seal (ST1) is not stressed by insertion of the product (P) into the new tubular pack (C1') and by thrust of the air trapped in the same new pack (C1') and positioned in front of the product (P), also as in this step it is possible for the pusher to insert the product (P) into the new pack with a relative speed that allows
5 slow and progressive backward discharge of the air that is compressed upstream of the same product (P) and against the leading end of the new pack (C1').

9. The method according to the preceding claims, wherein during the active movement away from the tube-forming mandrel (1), the double transverse heat-sealing and cutting assembly (13) is given all the time required to carry out its main
10 heat sealing and cutting operations and, in the last part of the same active movement, to open the heat sealers and the cutting means slightly to free the transverse heat seals (ST1, ST2) and allow action of the means for natural or forced cooling of these heat seals, while the wrapping of the packs upstream and downstream is held at all times by the pressers (63, 163, 63', 163'), which prevent
15 even minimum stress on said transverse heat seals (ST1, ST2).

10. The method according to the preceding claims, characterised in that in the initial step of its operating cycle, the double transverse heat-sealing and cutting assembly (13) can be closed only partially on the gusseted tubular wrapping (102') and in this partially closed condition can be moved slowly away from the tube-forming mandrel
20 (1) so as to move towards the pack downstream (C1') and compress it longitudinally, after which the same assembly (13) is fully closed and increases its speed of movement to carry out the double transverse heat sealing and intermediate cutting steps for which it is responsible.



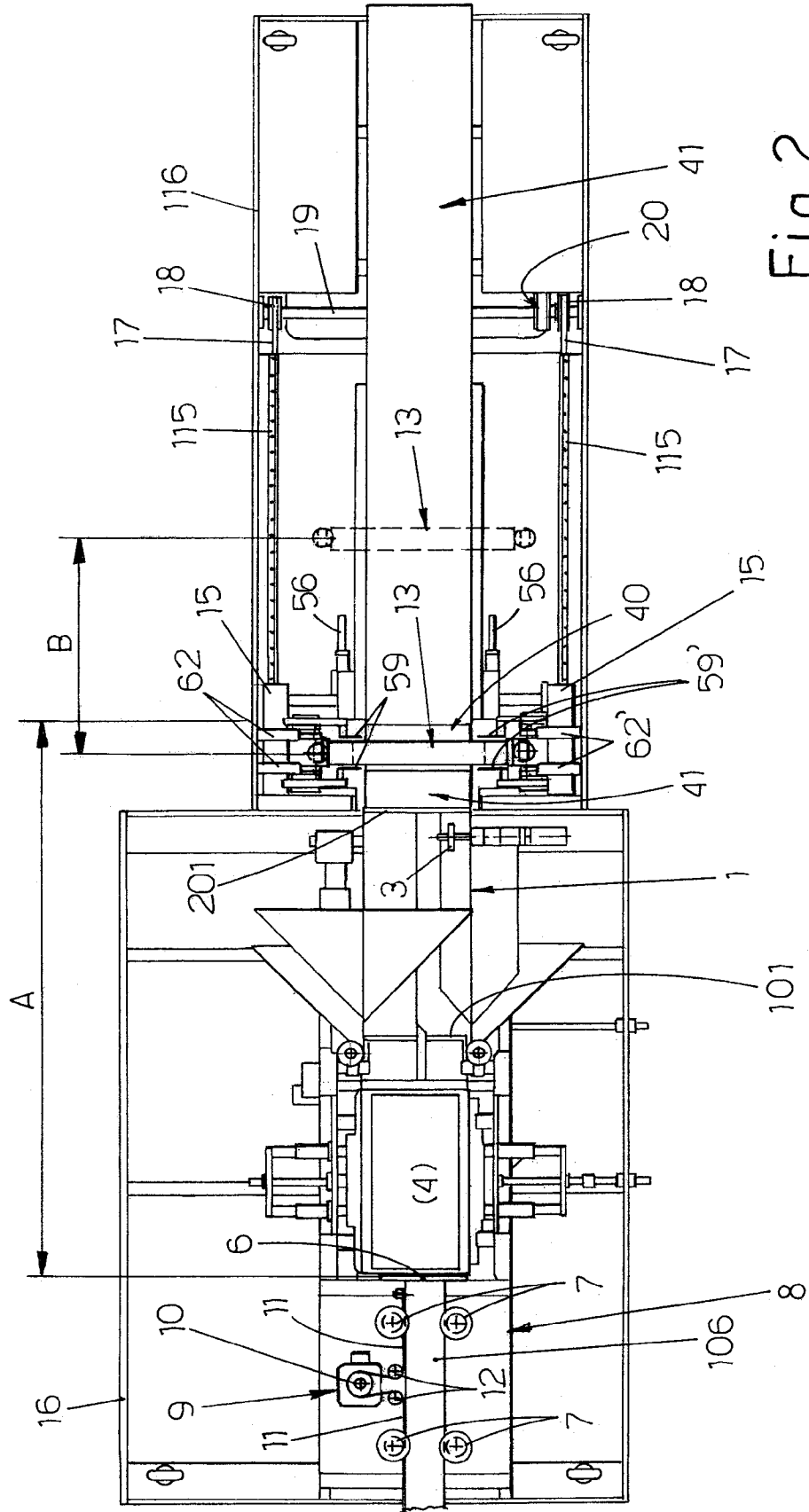


Fig. 2

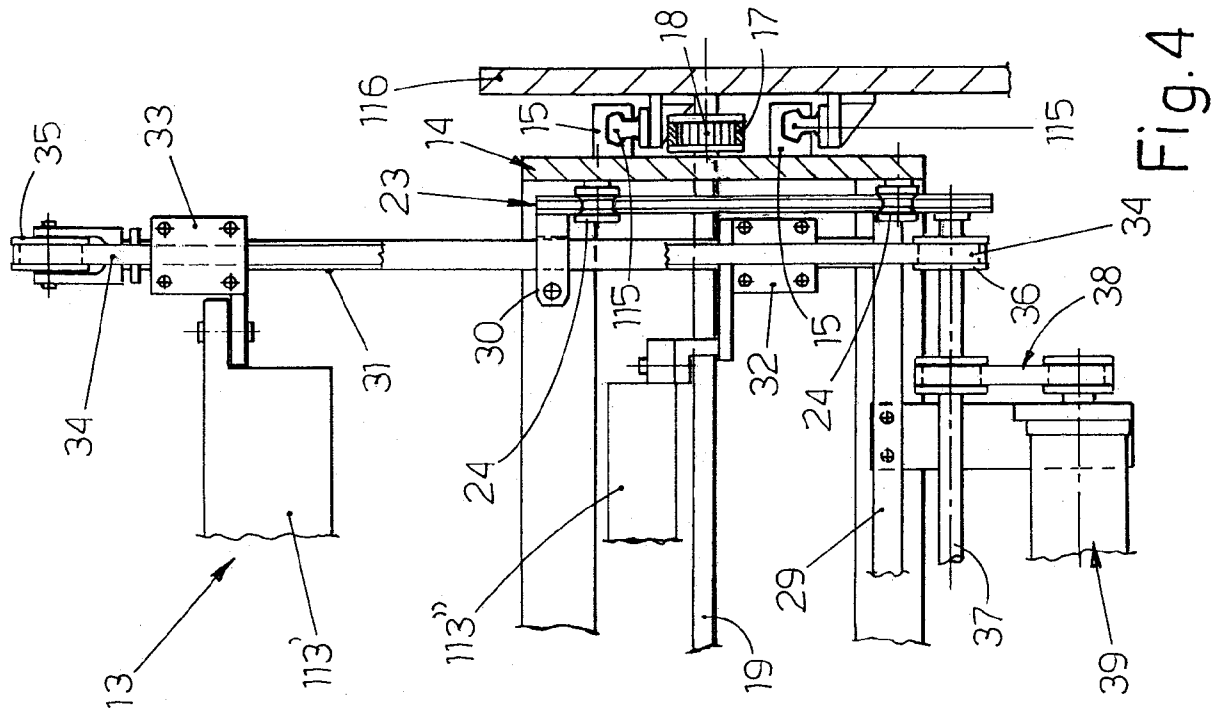


Fig. 4

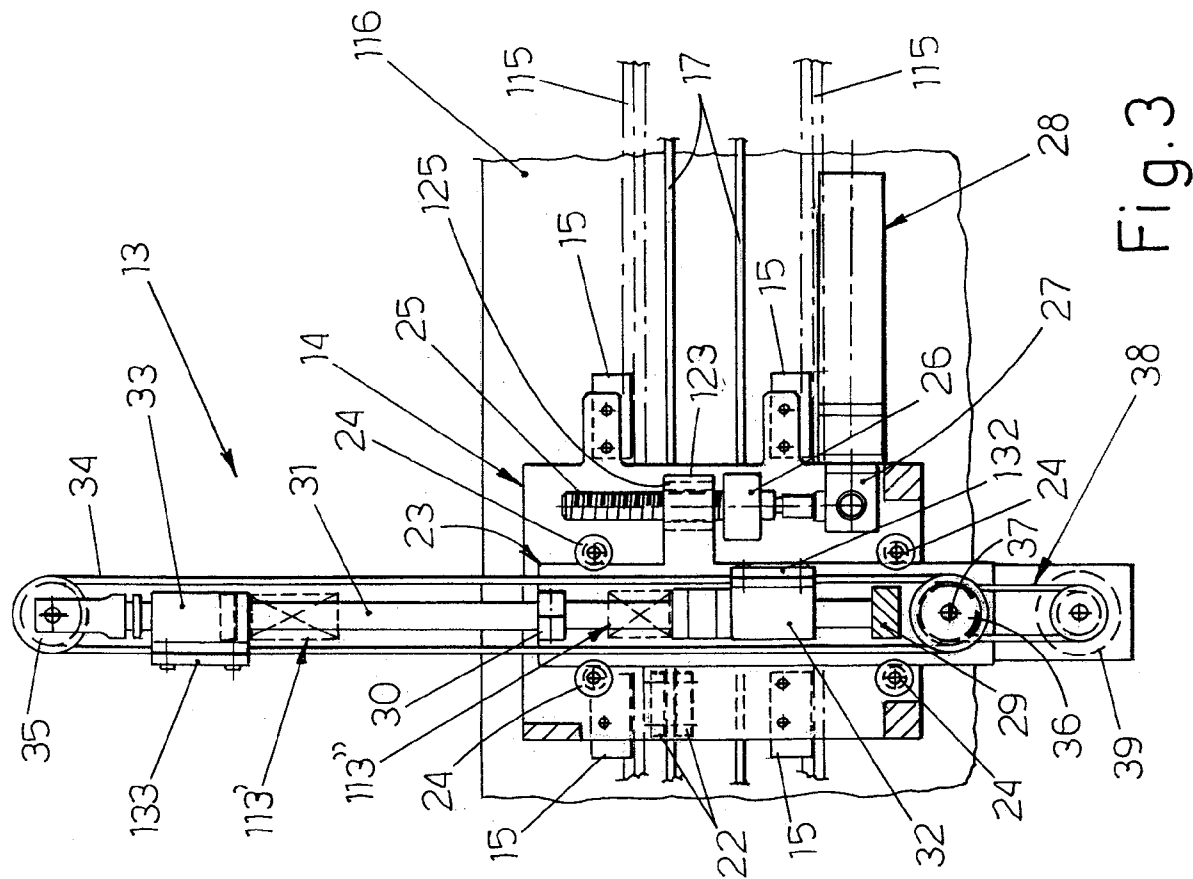


Fig. 3

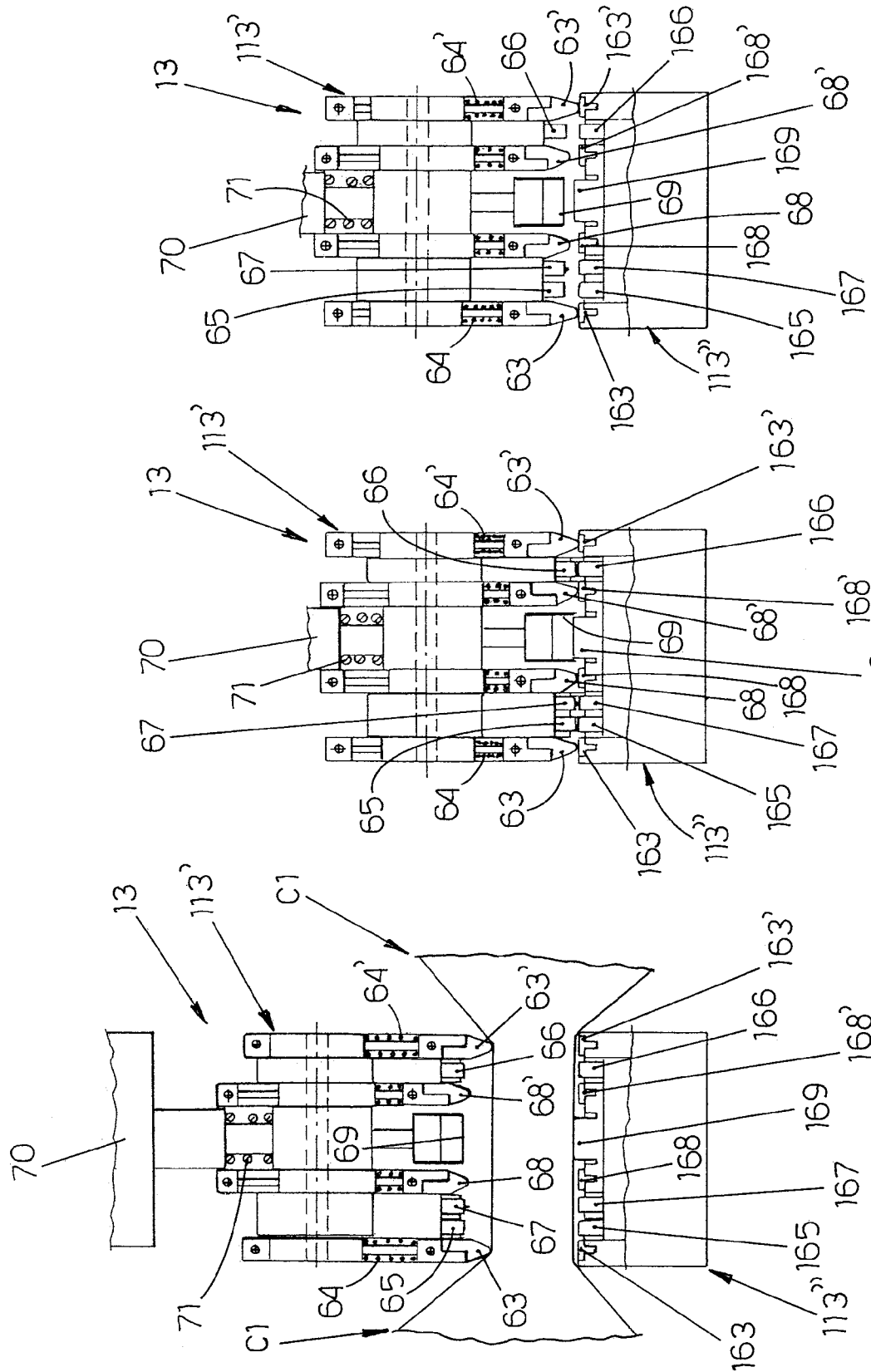


Fig. 5b

Fig. 5a

Fig. 5

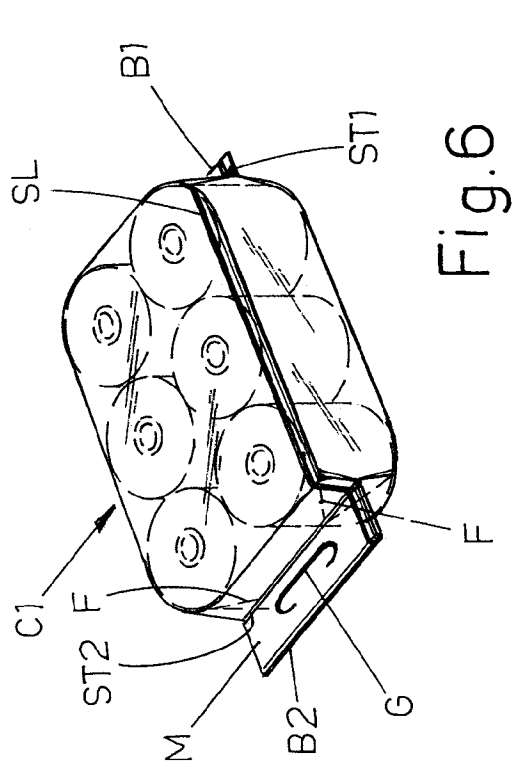


Fig. 6

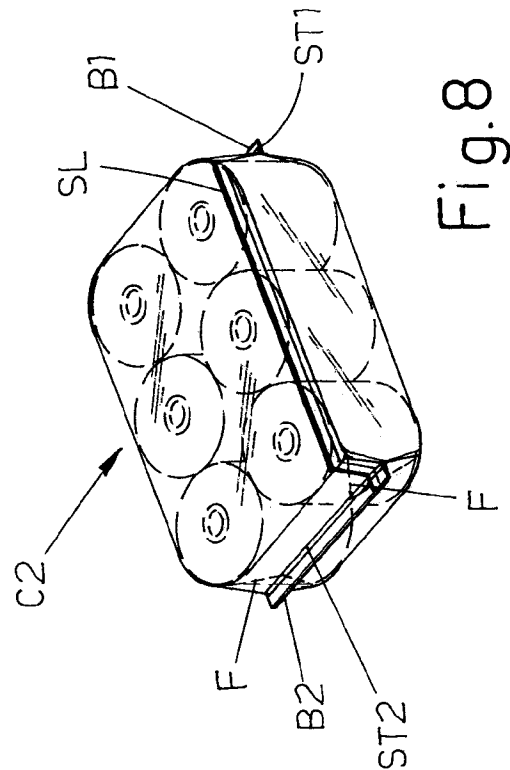


Fig. 8

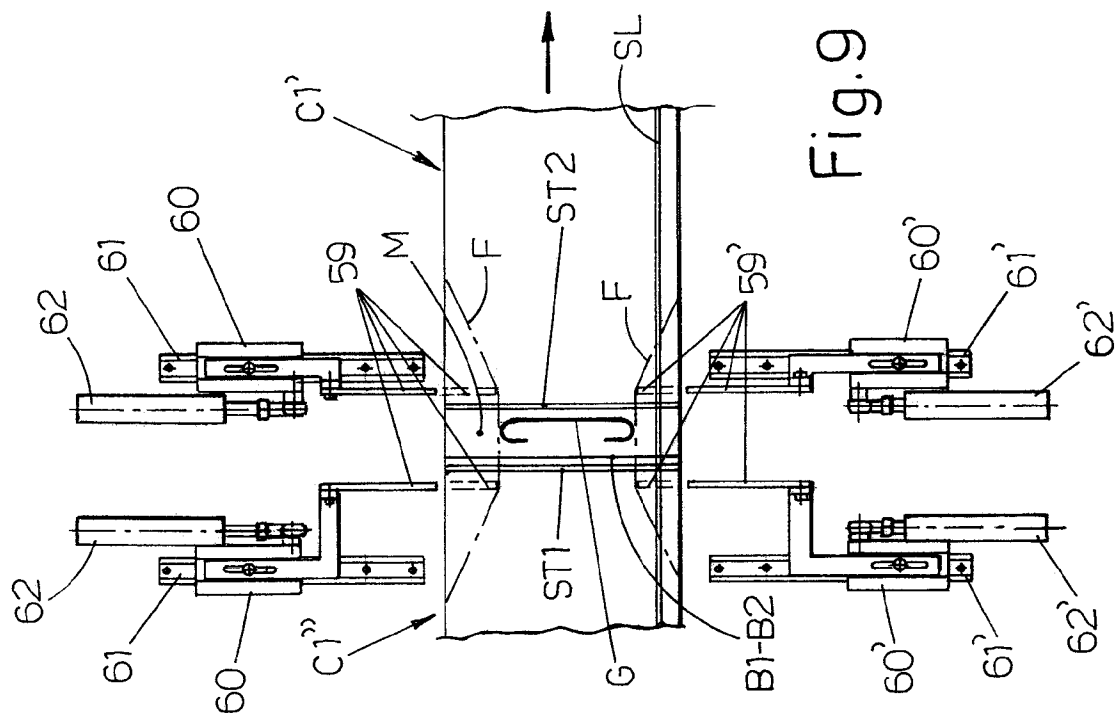
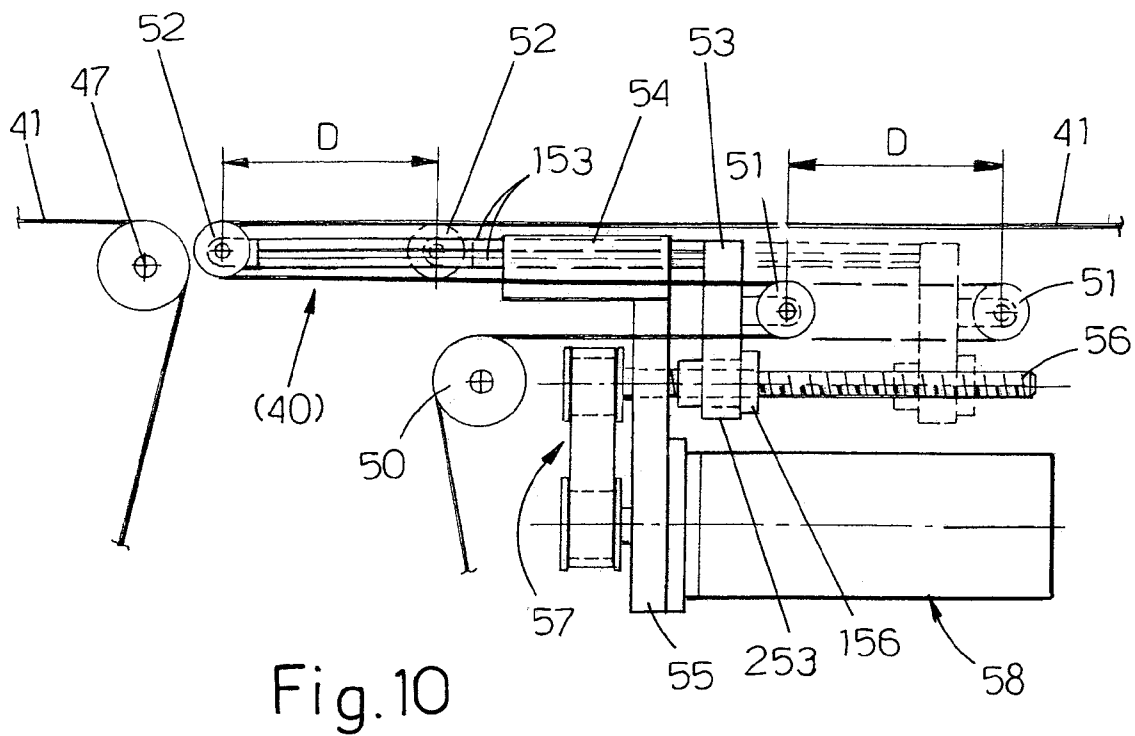
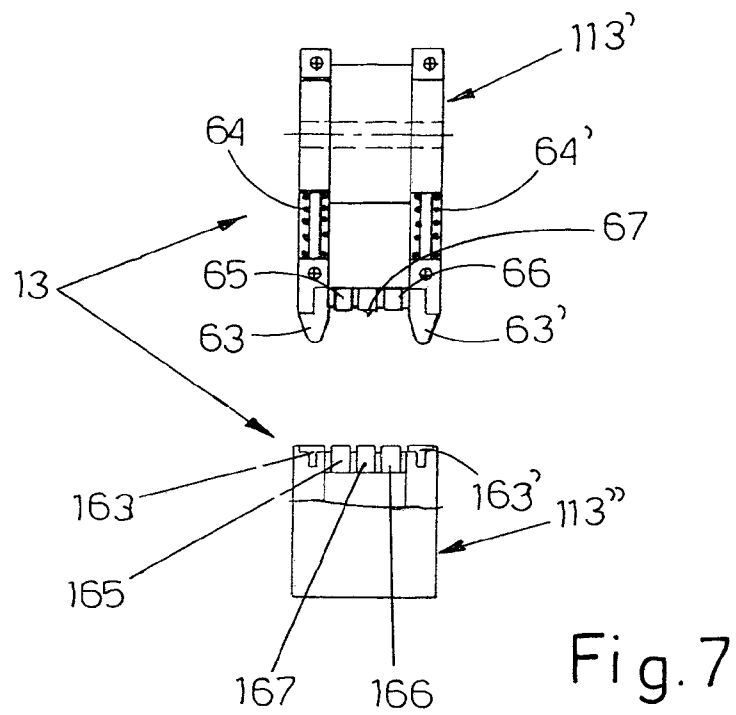


Fig. 9



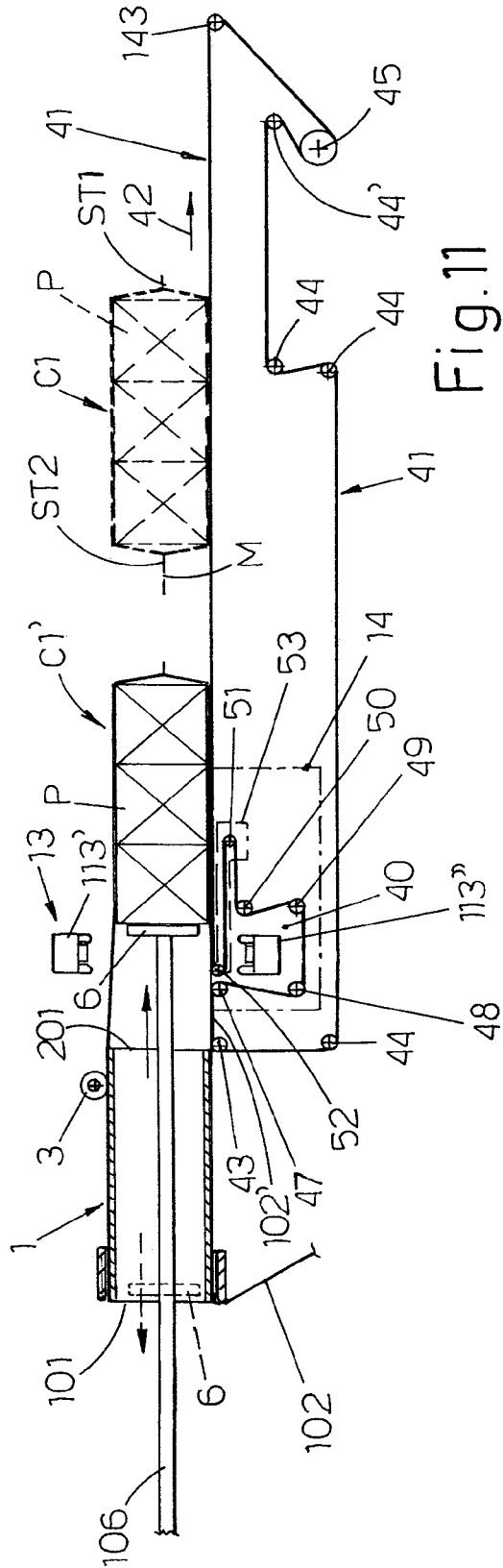


Fig.11

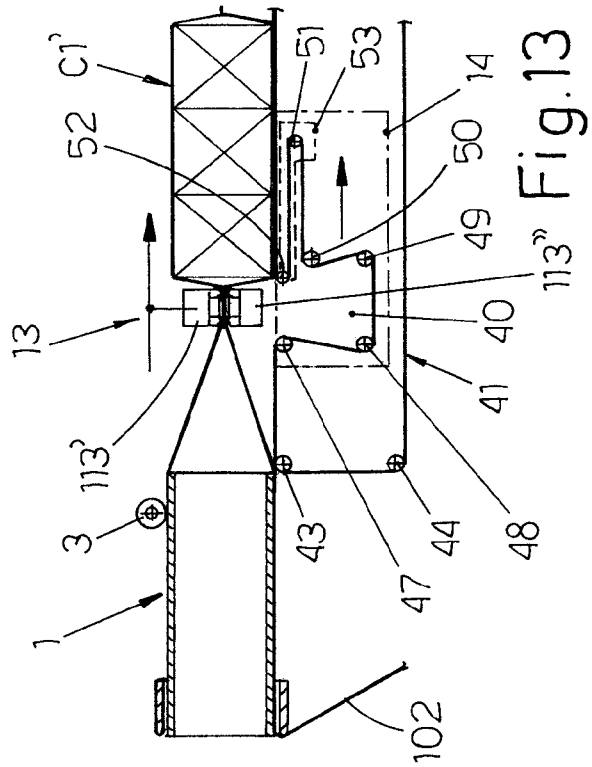


Fig.12

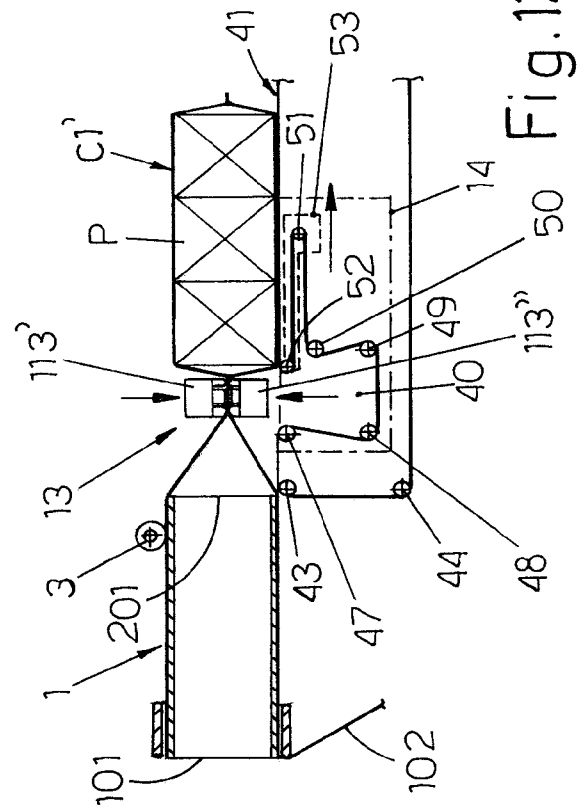


Fig.13

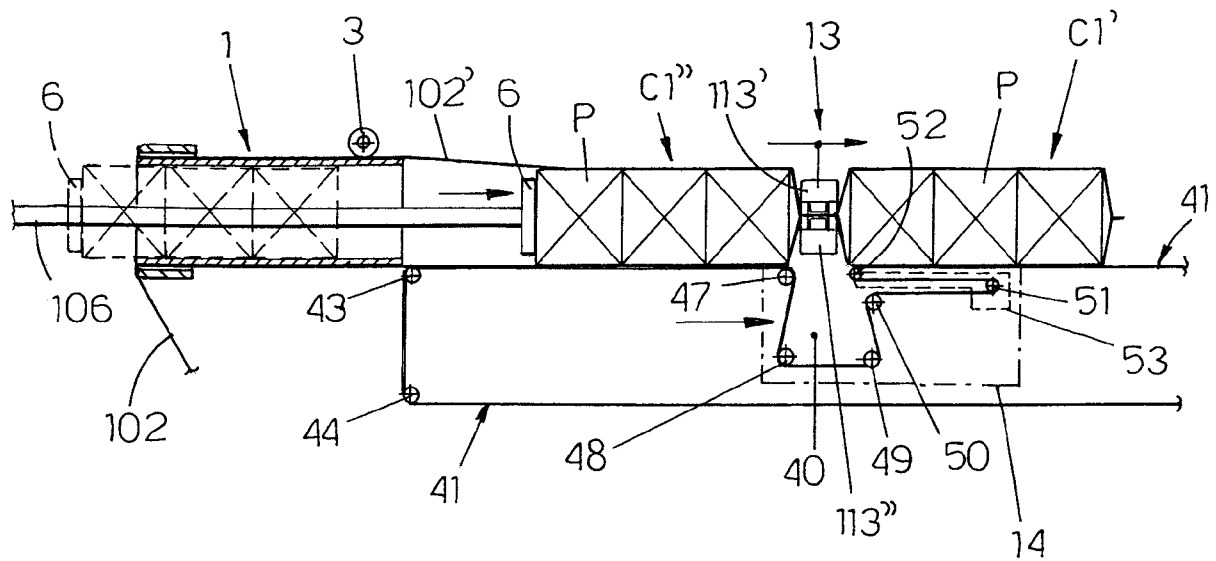


Fig.14

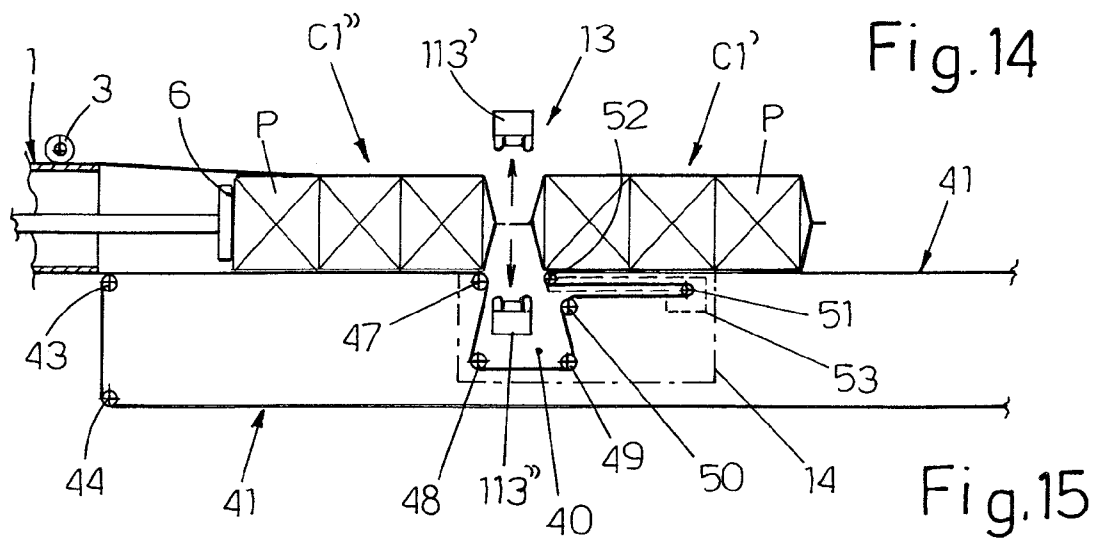


Fig.15

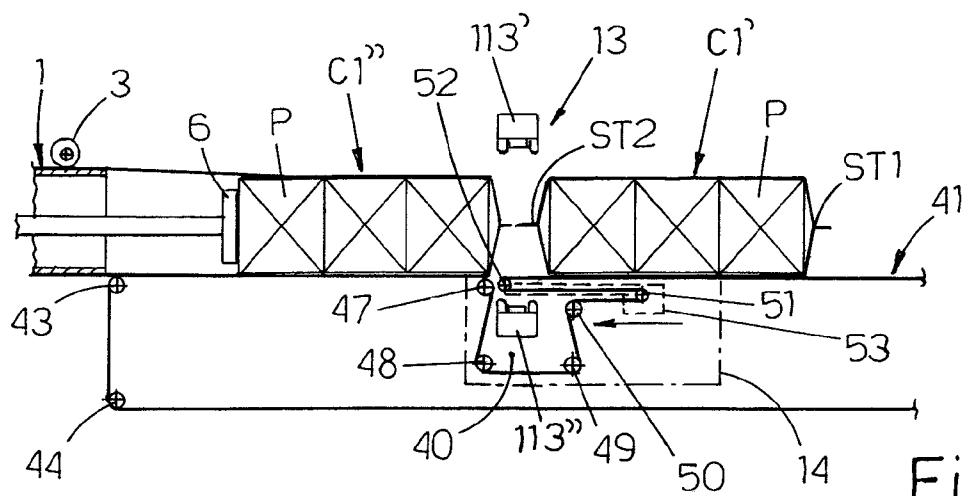


Fig.16

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/054007

A. CLASSIFICATION OF SUBJECT MATTER INV. B65B25/14 B65B51/30 B65B9/20 ADD. B65B61/10 B65B63/02 B65B9/213		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) B65B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	WO 02/053457 A1 (BELCO PACKAGING SYSTEMS INC [US]; GUZMAN FOSTER [US]) 11 July 2002 (2002-07-11) figures 1, 2, 3, 5, 11 -----	1-10
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A	US 4 715 166 A (KAMEDA HIROSHI [JP]) 29 December 1987 (1987-12-29) figures 1, 5 ----- -/-	1-10
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 1 September 2016	Date of mailing of the international search report 14/09/2016	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Vassoille, Philippe	

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2016/054007

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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International application No

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